

# **ENVIRONMENTAL ASSESSMENT**

## **Management of Feral and Free-Ranging Patas and Rhesus Monkey Populations to Reduce Threats to Human Health and Safety, Agriculture, Nuisances, and Impacts to Native Wildlife Species In the Commonwealth of Puerto Rico**

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## ACRONYMS

ADC	Animal Damage Control
APHIS	Animal and Plant Health Inspection Service
AVMA	American Veterinary Medical Association
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
DNER	Department of Environmental and Natural Resources
DOD	United States Department of Defense
EA	Environmental Assessment
EIS	Environmental Impact Statement
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
FEIS	Final Environmental Impact Statement
FDA	United States Food and Drug Administration
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
FONSI	Finding Of No Significant Impact
FY	Fiscal Year
GAO	General Accounting Office
IPM	Integrated Pest Management
IWDM	Integrated Wildlife Damage Management
MBTA	Migratory Bird Treaty Act
MOU	Memorandum of Understanding
NEPA	National Environmental Policy Act
NOA	Notice of Availability
NPS	National Park Service
NWR	National Wildlife Refuge, U.S. Fish and Wildlife Service
ROD	Record of Decision
SOP	Standard Operating Procedure
T&E	Threatened and Endangered Species
USDA	United States Department of Agriculture
USDI	United States Department of Interior
USFWS	U.S. Fish and Wildlife Service
WDM	Wildlife Damage Management
WS	Wildlife Services [formerly Animal Damage Control (ADC)]

## CHAPTER 1: PURPOSE AND NEED FOR ACTION

### INTRODUCTION

Across the world, natural systems are being substantially altered as human populations expand and encroach on wildlife habitats. Human uses and needs often compete with wildlife for space and resources, increasing the potential for conflicting human/wildlife interactions. In addition, segments of the public strive for protection for all native and non-native wildlife; this protection can create localized conflicts between humans and wildlife activities. The *Animal Damage Control (ADC) Programmatic Final Environmental Impact Statement (FEIS)* summarizes the relationship in American culture of wildlife values and wildlife damage in this way (USDA 1997):

*“Wildlife has either positive or negative values, depending on varying human perspectives and circumstances...Wildlife is generally regarded as providing economic, recreational and aesthetic benefits...and the mere knowledge that wildlife exists is a positive benefit to many people. However... the activities of some wildlife may result in economic losses to agriculture and damage to property...Sensitivity to varying perspectives and values are required to manage the balance between human and wildlife needs. In addressing conflicts, wildlife managers must consider not only the needs of those directly affected by wildlife damage but a range of environmental, sociocultural and economic considerations as well”.*

The United States Department of Agriculture (USDA) is directed by law to protect American agriculture and other resources from damage associated with wildlife. The primary authority for the United States Department of Agriculture-Animal and Plant Health Inspection Service-Wildlife Services program is the *Animal Damage Control Act* of March 2, 1931, as amended (46 Stat. 1468; 7 U.S.C. 426-426b and 426c); the Rural Development, Agriculture and Related Agencies Appropriations Act of 1988 (P.L. 100-202); and the Agriculture, Rural Development, Food and Drug Administration, and Related Agencies Appropriations Act of 2001, Public Law 106-387, October 28, 2000. Stat. 1549 (Sec 767)). USDA-Wildlife Services (WS) activities are conducted in cooperation with other federal, state, and local agencies, and private organizations and entities.

Wildlife damage management, or control, is defined as the alleviation of damage or other problems caused by, or related to the presence of wildlife (Leopold 1933, The Wildlife Society 1990, and Berryman 1991). The WS program uses an Integrated Wildlife Damage Management (IWDM) approach (sometimes referred to as IPM or “Integrated Pest Management”) in which a series of methods may be used or recommended to reduce wildlife damage. IWDM is described in Chapter 1, 1-7 of the *Animal Damage Control (ADC) Programmatic Final Environmental Impact Statement* (USDA 1997). These methods include the alteration of cultural practices as well as habitat and behavioral modification to prevent damage. The control of wildlife damage may also require the removal of an offending animal(s) or the reduction of localized populations of the offending species, through the application of lethal methods. Potential environmental impacts resulting from the application of various wildlife damage reduction techniques are evaluated in this environmental assessment.

According to the USDA, Animal and Plant Health Inspection Service (APHIS) procedures implementing the National Environmental Policy Act (NEPA), individual actions on the types of sites encompassed by this analysis may be categorically excluded [7 C.F.R. 372.5(c), 60 Fed. Reg. 6,000, 6,003 (1995)]. APHIS Implementing Regulations also provide that all technical assistance furnished by WS is categorically excluded (7 CFR 372.5(c)) (60 Federal Register 6,000, 6,003 (1995)). However, in order to evaluate and determine if there may be any potentially significant or cumulative impacts from the described control program, the Wildlife Services Program in the Commonwealth of Puerto Rico has

decided to prepare this environmental assessment (EA). This analysis covers WS's plans for current and future management actions wherever they might be requested or needed within the Commonwealth of Puerto Rico.

The purpose of this EA is to analyze the potential effects of the proposed control activities in the Commonwealth of Puerto Rico to reduce damage and conflicts associated with feral and free-ranging patas and rhesus monkeys. This analysis relies predominately on existing federal and state agency publications, including the *Animal Damage Control (ADC) Programmatic Final Environmental Impact Statement* (USDA 1997), information contained in scientific literature, and communications with other wildlife professionals.

All control activities will be in compliance with relevant laws, regulations, policies, orders, and procedures, including the Endangered Species Act (ESA). Notice of availability (NOA) of this document will be made consistent with the Agency's NEPA procedures in order to allow interested parties the opportunity to obtain and review this document and comment on the proposed management activities.

### **WILDLIFE SERVICES PROGRAM**

Wildlife Services (WS) is a cooperatively funded and service oriented program. Before any operational wildlife damage management is conducted, *Agreements for Control* or *WS Work Plans* must be completed by WS and the land owner/administrator. WS cooperates with private property owners and managers and with appropriate natural resource and wildlife management agencies, as requested, with the goal of effectively and efficiently resolving wildlife damage problems in compliance with all applicable federal, state, and local laws and Memorandums of Understanding (MOUs) between WS and other agencies.

Wildlife Services' mission, developed through its strategic planning process, is: 1) to provide leadership in wildlife damage management for the protection of American agriculture, endangered and threatened species, and natural resources and 2) to safeguard public health and safety. The WS' Policy Manual reflects this mission and provides guidance for engaging in wildlife damage management through:

- ♦ close cooperation with other federal and state agencies;
- ♦ training of wildlife damage management professionals;
- ♦ development and improvement of strategies to reduce losses and threats to publics from wildlife;
- ♦ collection, evaluation, and distribution of wildlife damage management information;
- ♦ cooperative wildlife damage management programs;
- ♦ informing and educating the public on how to reduce wildlife damage and;
- ♦ providing data and a source for limited-use management materials and equipment, including federal and state registered pesticides (USDA 1989).

### **PURPOSE**

In 2003, the USDA, APHIS, WS met with officials from the Puerto Rico Department of Environmental and Natural Resources (DNER) to discuss issues concerning feral and free-ranging populations of patas and rhesus monkeys in southwest Puerto Rico. The agencies represented at this meeting agreed that feral and free-ranging rhesus monkeys were a substantial health hazard and the patas monkey was impacting agriculture. Both species of monkeys are non-native and their potential impacts to the environment are not completely known, but of major concern. Therefore, DNER decided that it was going to be proactive and develop a strategy for alleviating monkey issues concerning human health and safety, agriculture, and natural resources on the Commonwealth of Puerto Rico. At this meeting it was agreed that an

environmental assessment (EA) would be prepared prior to implementing a feral and free-ranging patas and rhesus monkey control plan to assist in the decision making process.

The USDA, APHIS, WS Program decided to include the entire island of Puerto Rico and its satellite islands (including, but not limited to Desecheo, Cayo Santiago, Mona, Vieques, Culebra, etc.), instead of restricting the scope to southwestern Puerto Rico. This scope was decided to facilitate the timely response of WS to damage assistance requests received from other localities on the island.

## **PROPOSED ACTION**

The WS proposed action for this EA is an Integrated Wildlife Damage Management (IWDM) approach to reduce human health and safety concerns, agriculture damage, nuisance issues, and impacts to native wildlife species resulting from feral and free-ranging patas and rhesus monkey populations within the urban and rural environments of the Commonwealth of Puerto Rico. Populations of feral and free-ranging patas and rhesus monkeys would be reduced or possibly eliminated throughout Puerto Rico. This alternative would incorporate an integrated management program utilizing techniques described in Alternatives 3 and 4 (see Chapter 3). This strategy would incorporate non-lethal and lethal control measures. An IWDM strategy would be recommended and used, encompassing the use of practical and effective methods of preventing or reducing damage while minimizing harmful effects of damage management measures on humans, target and non-target species, and the environment. Under this action, WS could provide technical assistance and direct operational damage management, including non-lethal and lethal management methods by applying the WS Decision Model (Slate et al. 1992).

Management strategies involving exclusionary devices may be implemented by urban and natural resource management or WS personnel in accordance with WS recommendations. Population reduction of free-ranging patas and rhesus monkeys to reduce immediate health and safety concerns, agriculture damage, nuisance issues, and potential predation to native wildlife would be implemented by WS personnel with assistance from resource managers, as appropriate.

### **1.1 NEED FOR ACTION**

Humans have brought about the extinction and endangerment of more animals and plants than any other single force of nature, and some contributions leading to extinctions have been caused by the release or escape of domesticated and/or exotic animals (i.e., house cats, monkeys, dogs, hogs, goats) into previously uninhabited environments. Day (1981) addresses at least 3 species or populations of birds that have become extinct as a result of humans, habitat degradation, and the impacts of introduced Old World monkeys. The following is a synopsis of species whose extinction is believed to have been influenced by introduced Old World monkeys: St. Kitts Puerto Rican bullfinch (*Loxigilla portoricensis grandis*; Puerto Rico), Dodo (*Raphus cucullatus*; Mauritius Island), and Mauritius Blue Pigeon (*Alectroenas nitidissima*; Mauritius Island).

Wildlife professionals and lay persons often disagree as to what constitutes a feral animal. Van't Woudt (1990) uses three categories to classify the status of a domesticated animal observed in the wild: 1) an animal that stays in close proximity to its home or owner (tame); 2) an animal that may or may not have a home or owner but is reliant on humans for shelter and food (free-ranging); and 3) an animal that breeds and lives without human interactions (feral). For the purpose and scope of this EA, the WS Program in Puerto Rico will adopt Van't Woudt's (1990) definitions of tame, free-ranging, and feral domesticated animals, as described above. Additionally, WS will consider all domesticated animals, species, or breeds as feral or free-ranging animals when captured during control operations, unless an animal is readily identified with a collar and/or an identification tag.

### **History of Primates in the Caribbean**

Non-human primates have been traded in the Caribbean for 300 plus years due to primate research and commerce with West Africa. As a result of this trade and research, several Caribbean Islands have acquired populations of introduced monkeys. The vervet or green monkey (*Cercopithecus aethiops*) was imported into St. Kitts, Nevis, Barbados, and possibly St. Eustatius (Denham 1987). The mona monkeys (*Cercopithecus mona*) became established in Grenada (Denham 1987). Over the last 30 years three species of non-human primates have escaped captivity and have become established in the wild in Puerto Rico (rhesus macaque, *Macaca mulatta*; patas monkey, *Erythrocebus patas*; squirrel monkey, *Saimiri sciureus*).

The history of introduced monkeys in Puerto Rico began in the late 1930's. In November 1938, Dr. C. R. Carpenter imported 409 Indian rhesus macaques to Cayo Santiago, Puerto Rico to study ecology of free-ranging rhesus macaques. Cayo Santiago is now a world renowned research facility for the study of free-ranging rhesus macaques (Rawlins and Kessler 1986, Southwick 1989). In 1961, another facility, Parguera primate breeding colony, was established for the production of rhesus macaques (macaque is any monkey within the *Macaca* genus) for research purposes (Kerber et al. 1979). Macaques from India and Cayo Santiago were used to stock the islets of Cueva and Guayacan (Gonzalez-Martinez 1995). Early on, there was evidence that rhesus monkeys were leaving the breeding colony (Gonzalez-Martinez 1996). In 1971-1972, twenty-six patas monkeys were released on Cueva, part of the Boqueron Commonwealth Forest. Patas monkeys were brought in for two reasons: 1) to provide an additional primates species for use in medical research and 2) to more adequately utilize the resources on the island to study a second species (Loy 1989). By 1974, there were reports of patas monkeys leaving the island. In 1982 the Parguera primate breeding project was terminated [this facility was operating under National Institute of Health (NIH) funding and implemented by the Caribbean Primate Research Center]. In 1966, a population of 57 rhesus macaques was introduced on the island of Desecheo. The Desecheo primate ecology project was terminated in 1971. The Caribbean Primate Research Center of the University of Puerto Rico was established in 1970 in Sabana Seca (this is where the squirrel monkeys escaped).

### **Patas and Rhesus Monkeys in Puerto Rico**

Gonzalez-Martinez (1996) estimated rhesus and patas numbers ranged from 200 to 250 individuals. Their distribution was thought to be within a 26.8 km<sup>2</sup> area of southeastern Puerto Rico (Gonzalez-Martinez 1998). This area includes Sierra Bermeja, Lajas, and Cabo Rojo. Each species had preferred habitats within their core ranges. Gonzalez-Martinez (1995) does not believe the primates are impacting the environment to a significant degree, agriculture damage is exaggerated, and the neither species of monkey can be eradicated. Gonzalez-Martinez (1995 and 1996) clearly states that if the Puerto Rico monkey populations are allowed to increase in density and range, there is the potential for significant environmental and agricultural problems. It is also recommended that further dispersal and population expansion be prevented, and that the population size be reduced.

Gonzalez-Martinez (1996) concluded that patas and rhesus numbers were lower than previously thought in southwestern Puerto Rico. Patas numbers were estimated at 120 individuals consisting of 4 heterosexual groups (ranging from 20-38 individuals) and several male groups (2-7 individuals). Adult females accounted for 42% of the patas population followed by 29% juveniles, 16% adult and young males, and 13% infants (Gonzalez-Martinez 1998). Patas monkey density in the study area was 0.96 individuals/km<sup>2</sup>; patas monkey densities within the home range was 4.47 individuals/km<sup>2</sup>. In Puerto Rico, birthing season fell during the dry season, January-May; mating season was during the rainy



season, August-November. Each troop defended its home range in the Puerto Rico Study; however, this behavior was not observed in studies of patas monkeys in Africa.

Gonzalez-Martinez (1996) found two troops of rhesus macaques in the Sierra Bermeja area consisting of 65-85 individuals and an unknown number of satellite males. The distribution of age and sex categories was as follows: 49% adult females, 34% juveniles and infants, 17% adult and young males. Two troops of rhesus macaques were also found in the Cotui area and consisted of roughly 40-45 individuals. Rhesus densities in the Sierra Bermeja study area was 0.68 individuals/km<sup>2</sup> and within their calculated home range, 18.9 individuals/km<sup>2</sup>. Birthing season fell during the rainy season, April-August; mating season was during the dry season November-March (Gonzalez-Martinez 1995, Vandenberg and Vessey 1968). In 4 locations, Cayo Santiago, Northern India, La Parguera, and Sierra Bermeja, birthing consistently started during the rainy season (Gonzalez-Martinez 1995, Vandenberg and Vessey 1968).

Patas and rhesus monkey numbers are projected to be much higher than the numbers estimated in 1996. Jensen et al. (2004), estimate the rhesus monkey population to be around 500 individuals. This estimate is based on the assumptions that food resources are plentiful and that the population growth rate is 15% annually. Using a population growth-regression model, biologists with DNER (DNER, Wildlife Biologist Ricardo Lopez-Ortiz, per. comm., 2002) estimate rhesus macaques numbers to range between 400-600 animals in  $\approx 13$  clans (R=1.22). Patas monkey estimates are about 450 individuals in 19 female clans (R=1.16).

The distribution of both species is described in the following DNER communication (Lopez-Ortiz, per. Comm., 2004):

*"The population core of both species appeared to be from CABO ROJO and LAJAS .... They appeared to be mostly restrained to the south of the PR-2 highway from MAYAGUEZ to YAUCO but apparently solitary males have been reported, by civilians, crossing northward the highway in SANBANA GRANDE and YAUCO. Most patas reports are from CABO ROJO, LAJAS and GUANICA while rhesus appears to be more common in limestone haystack hills of the southern (in relation to the PR-2 highway) section of San German with few reports originated from the northern section of SAN GERMAN to MARICAO. Both species apparently use intermittent (mostly dry) creeks as corridors for their upland (northward) displacement and coastal mangroves and agricultural pastures for eastward and westward displacements.*

*Recent reports of free-ranging monkeys in BAYAMON and other eastern municipalities appeared to be fugitive individuals kept illegally as pets or from the Caribbean Research Primate Center Restraining Facility at Sabana Seca (close to BAYAMON)."*

### **Mortality Factors**

Caribbean populations of non-human primates have no natural predators and are shy and elusive (Gonzalez-Martinez 1995). Predation is not a limiting factor for monkeys in the Caribbean Islands. Most mortality comes from humans and natural injuries. Farmers are known to shoot crop-raiding monkeys. Additionally, some monkeys are lost due to the capture, trade, and sale of monkeys.

In the Cayo Santiago rhesus population, Kessler et al. (1988) determined that the tetanus toxoid was a significant mortality factor on the island (19.5%) Researchers concluded that the rhesus monkey on Cayo Santiago had little or no natural immunity to tetanus toxins (Kessler and Rawlins 1984). In 1985 researchers decided to give all monkeys tetanus inoculations. Following the tetanus inoculation, mortality due to tetanus decreased to 3.69%.

Schwartz et al. (1993) found that 8% of the Cayo Santiago rhesus monkeys were obese. In provisioned populations and captive colonies obesity could be a serious health factor. It was also speculated that populations with predation and limited resources would not achieve this degree of obesity.

Rabies is not known to be a major factor in controlling patas or rhesus monkey populations. However, rabies is ubiquitous in Puerto Rico and could be a serious health risk if monkeys begin invading urban areas. The Indian mongoose (*Herpestes auropunctatus*) is the primary source of rabies in Puerto Rico. Consequently, captive monkeys housed outdoors should be vaccinated against rabies (Ridriguez et al. 1996).

File and Kessler (1989) found that intestinal and tissue parasites were not a major problem with rhesus macaques on Cayo Santiago. Parasite loads were highest in the younger age classes and tended to decrease with the age of the monkey (Knezevich 1998). Females were found to be less infested than males. Typical parasites found in rhesus macaques at Cayo Santiago included: *Strongyloides fuelleborni*, *Trichuris trichiura*, and *Balantidium coli*. In Cayo Santiago, researchers believe that macaques may be eating soil to reduce the impacts of parasites (Knezevich 1998).

### **Age Determination**

Age determination in rhesus macaques focuses on tooth and mandible development. Kay and Cant (1988) found that tooth wear and cementum annulus counts on molars were most accurate for determining age in Cayo Santiago rhesus macaques. Combining both methods increased the reliable age estimate to within 1 year, up until the animal reaches 14 plus years. Bouvier (1988) tested aging macaques using mandibular bone development. From this study he found the mandible length and condylar width reliable for quick estimates on age class. These measurements were accurate within  $\pm$  5.08 months for males and  $\pm$  7.29 months for females.

### **Patas and Rhesus Monkey Behavior**

Bimodal feeding peaks were observed with captive provisioned (Cayo Santiago) and wild (Nepal) rhesus macaques. Feeding was heaviest during early morning and again in late afternoon (Marriott 1988, Marriott et al. 1989). Johnson et al. (1991) concluded that young females (4-6 years), females with young, or during pregnancy spent more time feeding and being vigilant than the older age class (11-15 years) of a rhesus group. Age structure and hierarchy were considered less important than physical energy requirements of the different age classes, as it pertains to length of time spent consuming food (Johnson et al. 1991).

Rhesus macaques in Puerto Rico have not become commensal with humans. In the less forested areas of north central India more than 80% of the rhesus population is commensal with humans. It appears that much of the commensal adaptation is related to loss of natural habitat and/or the availability and reliance on human sources for food (Southwick and Siddiqi 1994). Southwick (1989) analogized rhesus commensalisms in India and Pakistan with house mice and Norway rats. Currently, there is no indication that feral and free-ranging rhesus macaques are commensal with humans in Puerto Rico, even though there have been reports of monkeys in populated areas. Most rhesus populations were found in heavily forested areas (Gonzalez-Martinez 1996).

Rhesus macaques are considered full adults at 6 years of age. Average gestation period is 168 days. Birthing season is from February to May (Koford 1965). Breeding in Cayo Santiago is thought to be correlated to rainfall (Rawlins and Kessler 1985). Most births in northern India are during March and April (Rawlins and Kessler 1986), indicating that breeding starts during the rainy season.

Bercovitch (1993) and Bercovitch and Clarke (1995) found evidence to suggest maturation occurred earlier in males of a higher social status than in low ranking males in Cayo Santiago. In a study of adult male macaques at Cayo Santiago, Berard et al. (1993) concluded that social rank of males does not guarantee higher reproductive success (Manson 1995). McMillian (1989) found that young mature males had a better chance of reproductive success regardless of social rank. Berard et al. (1994) concluded sneaky mating tactics by males resulted in 45% of offspring siring. This would indicate that mate consortships are more productive when only a few females are in estrous and less successful when multiple females are in estrous simultaneously (Zorpette 1995, Berard 1999). Female reproductive success is thought to be more a product of survivorship and health rather than mate selection (Bercovitch 1997).

Rhesus macaques were documented to actively avoid inbreeding in the Cayo Santiago colony. Males were less discriminate breeders than were females. Females and males of the same matrilineages did not generally copulate with one another. Breeding by both male and female occurred most frequently outside the matrilineage (Manson and Perry 1993).

Male rhesus macaque mortality tends to increase between ages 2-6; female mortality tends to decrease during the same age period (Koford 1965). Multiple births are not the norm. The Cayo Santiago rhesus macaque's population rate of growth was 14% and 16% (Koford 1965, Rawlins and Kessler 1986, Rawlins et al. 1984). Annual mortality was estimated to be 6.7% for a 3-year period. Mortality did not increase with increase in density (Rawlins et al. 1984). Densities of provisioned macaques at Cayo Santiago were 6 times those of natural populations ( $\approx 13$  animals/hectare). The same provisioned macaques also supplemented their food intake with native vegetation on the Island. Of the one hundred sixty-three species of plants on the island, the monkeys used 73 species. Seventy-four of the 163 had medicinal value and 14 were toxic. The monkeys consistently avoided toxic species (Marriott et al. 1993).

Patas monkeys typically are seasonal or synchronous breeders with a polygynous mating system in the wild (Rowell and Hartwell 1978). Patas monkeys are considered mature at 4-5 years. In captivity, patas are not seasonal, indicating that food is the major factor determining breeding in this species (Rowell and Richards 1979). Harding and Olson (1986) observed a population of patas in Kenya and believe the patas breeding system is promiscuous polygyny. Usually a single, dominant male services multiple females (Rowell and Richards 1979). This system is temporarily abandoned when the "harem" male is displaced by a resident male and breeding by several males takes place (Ohsawa et al. 1993). The authors also found that sneaky males/females often contribute to the reproductive process in multi-male groups. However, groups with a single male did not have multiple male breeding within the harem (Kaplan and Zucker 1980). Loy and Harnois (1998) concurred with Kaplan and Zucker (1980) and Zucker (1987) that dominance was not a major factor with patas social structure, but disagreed with the theory that kinship was not a determinant factor in social relationships within captive patas monkey groups. Kaplan and Zucker (1980) determined that the intrasocial behavior of patas monkeys was regulated more on dispersal (active distance between individuals) and was associated with very little intrasocial interaction such as touching, grooming, etc. The mean gestation period for patas is 167 days (Loy 1981).

Patas monkeys in Uganda had a breeding season from July-August and the birthing season ranged from December-January. The 2 groups of patas monkeys studied had home ranges of 2340 ha and 3200 ha. Hall (1965) observed similar home ranges in East Africa. Females determine movement and sleeping sites. Patas monkeys preferred open acacia woodlands to heavily bushed/ heavily wooded and treeless areas (Chism and Rowell 1988). Mean density of heterosexual groups of patas monkeys in Cameroon was 21 (Struhsaker and Gartlan 1970). All male group numbers ranged from 2-6 individuals. Solitary or

satellite males were seen infrequently. Breeding and birthing seasons corresponded to rainy and dry seasons, respectively.

Trees chosen for sleeping in at night were a different shape from those used for day resting. Day resting trees had wide, low, spreading crowns, while sleeping were not unusually tall but had narrow crowns with few branches near the ground. At night, each patas (except dependent infants) slept in a separate tree. Monkeys already settled in trees threatened others which tried to enter the same or even adjacent trees. The effect of this behavior was that the groups were widely spread out at night, often over two hectares or more. A group never used the same sleeping trees on consecutive nights, so that it needed extensive woodland in its range just for sleeping (Chism and Rowell 1988).

Vocalizations of patas monkeys in response to different predators are described in Chism and Rowell (1988).

*"Canids and humans were responded to with a low chatter audible over only about 50 m. This was usually followed by rapid flight into woodland rather than out across open areas. When a leopard or cheetah was detected, the group moved up into the trees, gave loud alarm calls and looked in the direction of the predator. Males gave two-phase alarm barks to large felids, while females and juveniles gave high pitched chirps. Females occasionally gave a high-pitched version of the male two-phase bark as an alarm call."*

Savanna baboons (*Papio cynocephalus*) often occupy and use the same ranges as patas monkeys in Africa, but the 2 species exhibit completely different behavior. Patas monkeys generally have a "harem" social organization, whereas baboons have a multiple male system. Breeding in baboons differs by being more "female defense polygyny". Female patas monkeys have a single menstrual cycle, where baboon females have multiple menstrual cycles before conception (Bercovitch 1995). Female baboons are not known to breed seasonally, they are considered opportunistic breeders (Bercovitch and Harding 1993). Female baboons develop exaggerated swelling in the anogenital area for  $\approx$  18 days of the menstrual cycle (Bercovitch 1991). Swelling in female patas monkeys is not as exaggerated as in baboons. Female baboons begin the first menstrual cycle between 4.5 to 5.6 years of age and do not give the first birth until ages 6.5 to 7 (Bercovitch and Strum 1993).

Patas females do not exhibit exaggerated perineal sexual swelling as do most of the other cercopithecoid species. Additionally, Bercovitch (1996) found no evidence that male scrotal color change as a result of breeding condition, age, health, or seasonally. However, rhesus monkey scrotal color changed to a more intense red during breeding season. Loy (1974) found that nose coloration of pregnant patas monkeys from the subspecies *E. p. pyrronotus* changed from black to white during mid to late pregnancy. This color change could serve as a reliable indicator of pregnancy in patas monkeys in Puerto Rico.

In a study of 7 primates in Africa, researchers observed that forest-dwelling species were usually slow maturing and grassland species are faster maturing. Rowell and Richards (1979) concluded that vervet and patas monkeys are r-selected species. This would also indicate that rhesus monkeys were K-selected species, thus, slower to develop and mature.

### **1.1.1 Need for Feral and Free-Ranging Patas and Rhesus Monkey Management to Protect Human Health & Safety**

Jensen et al. (2004) and other researchers have indicated that most exposures are laboratory primate researchers and rhesus macaque pet owners (Holmes et al. 1990). Primate researchers in the laboratory setting are highly trained on protective gear use etc. to avoid exposure to B-virus. However, primate researchers dismiss B-virus as a serious threat to humans in Puerto Rico (Jensen et al. 2004). But, they

also have concerns that many people in Puerto Rico are not educated (doctors and laypersons) about the potential risks of macaques and B-virus and may be more at risk of acquiring the disease. Presence of B-virus in macaques does not kill the macaque or impede the animal's life. However, monkeys outside the macaque complex and humans are severely impacted by B-virus exposure (Huff and Barry 2003). Other species of monkey and humans (70%) die from the infection. The authors also indicate that most the studies conducted on this subject are in the laboratory setting and few if any studies have been conducted on wild populations of rhesus macaques as it relates to this disease (Engel et al. 2002). It is also strongly suggested that wild or free-ranging rhesus macaques could become stressed when trapped or confined and reactivate the shedding of the B-virus. Kapsalis (1985) and Laundenslager et al. (1999) found trapped and/or relocated monkeys become stressed and aggressive. Monkeys relocated to other unrelated groups caused high stress and potential mortality (Kessler et al. 1985).

In the following paragraphs Jensen, et al. (2004) describe the transmission of the macaque B-virus (*Cercopithecine herpesvirus 1*) to humans.

*"Most transmissions have occurred through monkey bites or scratches, but cases have been documented from needlestick injuries or other laboratory-related accidents, cage scratches, or mucous membrane exposure to monkey body fluids.....B-virus infection should be recognized early and antiviral prophylaxis given promptly. Early signs of infection in humans include influenzalike symptoms, such as headache, nausea, vomiting, and muscle pain. Vesicular herpetic lesions, pain, or itching might arise around the area of exposure. The disease progresses quickly to a fulminating meningoencephalitis. Symptoms include paralysis (often progressive and ascending), numbness, ataxia, respiratory difficulties, urinary retention, altered consciousness, and coma. The few cases that have been treated by the time neurologic symptoms have emerged have had limited success.*

*..... Stress will increase the likelihood that the virus will be reactivated and shed. Illness, transport, breeding, or environmental stresses have been reported as factors increasing a macaque's likelihood of shedding the virus and therefore becoming infectious. Typically, a very low percentage (2%-3%) of seropositive monkeys will shed the virus at any given time....."*

Eighty-two percent of monkeys sampled in Cayo Santiago were seropositive for the B virus in 1967 (Kessler and Hilliard 1990). The B Virus is considered enzootic in Cayo Santiago. Twenty-three percent of yearling and two-year-old, 84% of three- to four-year-old, and 100% of monkeys  $\geq 5$  years of age were positive (Kessler and Hilliard 1990).

In the United Kingdom the Macaque B-virus is considered a Level 4 pathogen in Under Control of Substances Hazardous to Health regulations. Any macaque infected with this virus in the UK is to be destroyed. Facilities that hold macaques are now required to test the animals for B-virus antigens. In the UK, 4/9 cases of B-virus infection have died since acyclovir became available and "survivors usually have neurological sequelae" (CDC 2000).

CDC (2001) recommends that all macaques be treated as potentially infectious. Since the 1930's, 43 human deaths have been reported from exposure to B-virus (Engel et al. 2002, CDC 2001). Most documented infections have occurred among bioresearchers and pet owners. There has been 1 documented case (1997) of ocular exposure to B-virus while handling a macaque. The researcher died, even with treatment for B-virus exposure (CDC 2001). CDC (1998), states that macaques are unsuitable as pets because of this disease threat.

In addition to B-virus, monkeys have been known to transmit numerous other diseases to humans (Wolfe et al. 1998; Table 1). Two types of viral hemorrhagic fevers, Ebola and Marburg, have been passed to laboratory researchers (CDC 1989, CDC 1990). Several simian immunodeficiency viruses (SIV)

potentially may affect humans (CDC 2002). Malaria may also be transmitted from infected monkeys to humans (Cogswell 2000). Two species of *Plasmodium* have been found in rhesus monkeys (*P. cynomolgi* and *P. inui*). Hepatitis A and Hepatitis B may be found in the patas and rhesus monkeys, respectively. The diseases listed above are all known diseases; however, there is the potential for other unidentified or undiscovered diseases to exist (Renquist and Whitney 1987, Weber et al. 1998).

Table 1. Routes of pathogen exchange between human and nonhuman primates.

Route of exchange	Pathogen	Direction of Exchange	Evidence <sup>a</sup>	Reference
Animal bite	Herpes B; Monkeypox	Nonhuman primate to human; Nonhuman primate to human	E	6 <sup>b</sup>
Fecal-oral	Poliovirus	Human to nonhuman primate; Chimpanzee to Chimpanzee	E E	7 8
Hunting, food prep & eating	Ebola	Nonhuman primate to human	E	9
Nasal secretions	<i>Mycobacterium leprae</i>	Among primates	P,L	10 <sup>b</sup>
Vector-borne	Malaria Filaria	Both Directions Both Directions	L,E L,E	12 <sup>b</sup> 8 <sup>b</sup>
Water-mediated	Dracunculiasis;  Schistosomiasis	Human to nonhuman primate; Nonhuman primate to human	L E	13 14
Xenotransplantation	SV40	Nonhuman primate to human	E <sup>c</sup>	15 <sup>b</sup>

<sup>a</sup> L = laboratory; E = epidemiologic; P = evidence that parasites live naturally in multiple primate hosts.

<sup>b</sup> Evidence reviewed.

The only current evidence for xenotransplantation includes SV40 spread through vaccine production.

Note: Table adopted from Wolfe et al. 1998.

Historically, few disease issues have emerged from the monkeys in southwest Puerto Rico. However, over the last 10 years monkey numbers have increased, resulting in more frequent encounters with humans. Human encounters can range from stopping vehicular traffic to raiding backyard fruit trees. Fortunately, the rhesus macaques have not formed the type of commensal relationships with the humans of Puerto Rico as they have with humans in India. However, in time it is possible that this relationship will develop in Puerto Rico if the issue is not addressed in advance. The Puerto Rico DNER is being proactive in an effort to reduce the potential of such interactions and potential disease issues with both patas and rhesus monkeys by developing an EA with the USDA, APHIS, WS Program.

### 1.1.2 Need for Feral and Free-Ranging Patas and Rhesus Monkey Management to Protect Wildlife and Agriculture

In 1966 the National Institute of Health (NIH) released a group of 57 rhesus monkeys on Desecheo Island to study primate ecology and behavior. By 1969 there was concern that the monkeys might impact the nesting boobies. It is suspected that by 1970, the colonies of nesting boobies had been eradicated by nest predating monkeys (Evans 1987). In 1970, NIH ended its research on the island and allowed the Caribbean Primate Research Center to continue ecological studies. Studies of the introduced rhesus monkeys were discontinued by the end of 1971. Raffaele (1989) indicated that the Desecheo breeding population of red-footed booby (*Sula sula*) had been “drastically reduced by predation from introduced monkeys”. A few breeding pairs have started nesting on other islands uninhabited by monkeys or other predators. Evans (1987) believes that the introduced monkey populations of Desecheo may have significantly impacted red-footed booby, brown booby (*Sula leucogaster*), noddy tern (*Anous stolidus*), and bridled tern (*Sternus anaethetus*) nesting colonies on the island. Evans (1987) believes there is evidence that the monkeys have become opportunistic nest predators on the island. Another group of animals potentially at risk from foraging monkeys is reptiles (Evans 1987). Three species of endemic lizards are found on Desecheo (Desecheo gecko, *Sphaerodactylus levinsi*; Desecheo anole, *Anolis desecheensis*; Desecheo ground lizard, *Ameiva desecheensis*).

In Mauritius Island, several researches have implicated the long-tailed macaque (*Macaca fascicularis*) with the decline and/or extinction of some endemic bird species (Sussman and Tattersall 1986). Other researches do not believe the introduced monkey had a significant impact on the endemic flora or fauna. Sussman and Tattersall (1986) state that the monkeys may feed on eggs and fledgling birds but there is no evidence that they are a real threat to plant or animal life.

Caribbean populations of primates have no natural predators and are shy and elusive (Gonzalez-Martinez 1980). Eradication attempts have been unsuccessful to date. Vervet monkeys in Barbados are a significant agriculture pest (Denham 1987, Baulu et al. 1987) and in St. Kitts the vervet is implicated with contributing to the extinction of the St. Kitts Bullfinch [*Loxigilla portoricensis grandis* (Bond 1985)]. In Puerto Rico, the patas monkey has become an agriculture pest. Annually, over \$20,000 of damage has been attributed to patas monkeys (Lopez-Ortiz, pers. comm., 2004).

There is circumstantial evidence of monkeys depredating nests of yellow-shouldered blackbirds, *Agelaius xanthomus* (Lopez-Ortiz, per. Comm., 2004). This is an endangered species mainly because of brood parasitism by shiny cowbirds, *Molothrus bonariensis*, and predation by introduced species (Lopez-Ortiz et al. 2002, Post and Wiley 1976, Wiley et al. 1991). Only 770-1200 were thought to remain from 1982-1986. DNER biologists believe that in less than a week in June 2002, monkeys raided and destroyed the contents of 30 yellow-shouldered blackbird nests (built in artificial nest structures) being monitored by researchers in the Boqueron State Forest (Lopez-Ortiz pers. comm., 2002).

Unpublished data indicate that monkeys cause damage to cantaloupes, watermelons, pumpkins, and vegetables in Southwest Puerto Rico (Lopez-Ortiz, per. Comm., 2004). Annually, both patas and rhesus monkeys cause more than \$20,000.00 in damage to crops. As a result, farmers have started cultivating hay instead of fruits and vegetables to alleviate monkey damage. It is speculated that the change in crop type in the lower elevations may reduce the abundance of food available to the monkeys in the lowlands and force the monkeys into upland areas where coffee, banana, or citrus plantations exist. Several mayors in towns of Southwest Puerto Rico have filed formal complaints with the Puerto Rico Department of Agriculture and DNER concerning issues with patas and rhesus monkeys. Over the last decade the complaints appear to be increasing. The Puerto Rico DNER is being proactive in an effort to reduce the

potential of such interactions and potential disease issues with both patas and rhesus monkeys by developing an EA with the USDA, APHIS, WS Program.

### **1.1.3 Need for Feral and Free-Ranging Patas and Rhesus Monkey Management to Reduce Potential Nuisance Issues**

Historically, few nuisance issues have emerged from the monkeys in southwest Puerto Rico, other than crop raiding. However, over the last 10 years monkey numbers have increased, resulting in more frequent encounters with humans. Human encounters can range from stopping vehicular traffic to raiding backyard fruit trees. Fortunately, the rhesus macaques have not formed the type of commensal relationships with the humans of Puerto Rico as they have with humans in India. The Puerto Rico DNER is being proactive in an effort to reduce the potential of such interactions and potential disease issues with both patas and rhesus monkeys by developing an EA with the USDA, APHIS, WS Program.

### **1.1.4 Review of Feral and Free-Ranging Patas and Rhesus Monkey Control Measures in Scientific and Popular Literature**

Trapping is the most common technique for capturing primates. Traps can range from home-made cage traps to the professional Tomahawk live trap. The key to live trapping is location and prebaiting. Primate live capture often is expensive and laborious to conduct. Live capture difficulty is often dependant on species, topography, climate, season, food availability and other unknown factors. Live trapping of primates can also be stressful to the animal and has the potential of causing injuries (Eisenberg 1981). It has also been suggested that the use of a decoy might be advantageous in primate trapping. Decoys can also be used to dart or net the targeted primate. Live trapping vervet populations in Barbados has shown a population shift towards younger ages classes and an increase in agriculture damage complaints. This would indicate that adults were more susceptible to trapping than younger age classes and that the younger age classes are more serious agriculture pests than adults (Horrocks and Baulu 1988).

Evans (1987) conducted rhesus macaques control on Desecheo Island. Initially, the author prebaited and habituated the macaques to food in cage traps. Members of the troop that were not captured initially became wary and trap-shy. Before control efforts on the island, Evans (1987) found that the average flight distance of the macaques was 30 + meters when disturbed. Later, after control efforts were underway, flight distance was much greater. Once the monkeys developed an aversion to the traps, trapping was replaced by shooting.

Darting is a technique often used to capture individuals or small numbers of primates. It is not a device practical to capture large numbers of animals at any one time. Darting devices may include blowguns, dartguns, and crossbows. Effectiveness of using this method is dependant on vegetation density, canopy height, species, topography, etc. Darting is also more prone to injuring an animal by falls, blunt-force trauma of dart, and overdosing. On Desecheo Island Evans (1987) found that tranquilizer guns where not effective because of sight distance. Welfare of monkey once tranquilized was of concern, plus traumatic injuries such as broken bones, punctured abdomen, etc. It was concluded that darting was not practical on the island (Evans 1987).

Nets have been used to effectively capture both small and large primates. Uses of netting material could vary from barrier type devices, drop nets, cannon nets, or mist nets. The type of net used depends on species, habitat, application, and vulnerability of animal. Set-up of capture nets can be very labor intensive and could cause injury to both the trappers and/or monkeys (Eisenberg 1981).



Several researchers have suggested various methods of reducing crop damage caused by monkeys. Some of the suggested methods include the use of electric fencing, dogs, and live-trapping of problem animals and juveniles. It has also been suggested that only a small proportion of a population can be live-trapped, thus, making eradication using this method impossible (Evans 1989, Gonzalez-Martinez 1996, Horrocks 1986, Horrocks and Baulu 1988, Lippold 1989, Marriot et al. 1983, McGuire 1974, Morrison and Menzel 1972, Poirier 1972, Sade and Haldebrech 1965, USFWS 1994). Gonzalez-Martinez (1996) suggested that monkey densities could be controlled by sterilization and the removal of young breeding females from each group. Theoretically, sterilization would work if all females were effectively sterilized, but this seldom, if every is likely in nature. Effectively, sterilization would shift the age structure of the groups.

St. Kitts' farmers have used scarecrows, dogs, hunters, and trappers, and harassment to discourage crop-raiding monkeys for years, but none of this has stopped the green monkey from raiding crops (Poirier 1972). Similar responses to herdsman and farmers were observed with patas monkeys in Tenzugu, Kenya (Chism and Rowell 1988). Hunting and shooting is a method commonly used by farmers to discourage crop-raiding monkeys. It is widely known that next to habitat destruction, hunting (collecting) has been the next major threat to populations of macaques in Indonesia (Rosenbaum et al. 1998). Worldwide primate population declines can be attributed to habitat loss and over-hunting (Rosenbaum et al. 1998).

## **1.2 WILDLIFE SERVICES OBJECTIVES - PUERTO RICO**

The need to manage free-ranging patas and rhesus monkeys to resolve human health and safety concerns, nuisance issues, agriculture damage, and impacts to native wildlife species in the Commonwealth of Puerto Rico was used by WS, with input from the Puerto Rico Department of Natural Resources and Environment, to define the objectives for the WS program in Puerto Rico. WS' objectives for the management of free-ranging patas and rhesus monkeys in Puerto Rico and for cooperative agreements and agreements for control within the Commonwealth of Puerto Rico are to:

- ♦ Respond to 100% of the requests for assistance with the appropriate action (technical assistance or direct control) as determined by WS personnel, applying the ADC Decision Model (Slate et al. 1992).
- ♦ Reduce and eliminate free-ranging patas and rhesus monkey populations to the greatest extent possible, on properties with a federal WS operational program.
- ♦ Reduce or eliminate human health and safety and nuisance issues concerning feral and free-ranging patas and rhesus monkey to the greatest extent possible, on properties with a federal WS operational program.
- ♦ Reduce or eliminate the impact of feral and free-ranging patas and rhesus monkeys on native wildlife species and agriculture, on properties with a federal WS operational program.
- ♦ Maintain the lethal take of nontarget animals by WS personnel during damage management to less than 1% of the total animals taken.

## **1.3 RELATIONSHIP TO OTHER ENVIRONMENTAL DOCUMENTS**

**ADC Programmatic EIS.** WS [formerly known as Animal Damage Control (ADC)] has issued a Final Environmental Impact Statement (FEIS) on the National APHIS/WS program (USDA 1997). Pertinent and current information available in the Final EIS has been incorporated by reference into this EA.

#### **1.4 DECISION TO BE MADE**

Based on agency relationships, MOUs, and legislative authorities, WS is the lead agency for this EA, and therefore, is responsible for the scope, content, and decisions made. The Department of Environmental and Natural Resources (DNER) and USFWS provided input throughout the EA preparation process to ensure an interdisciplinary approach according to NEPA and agency mandates, policies, and regulations.

Based on the scope of this EA, the decisions to be made are:

- ♦ Should WS attempt to reduce or possibly eliminate free-ranging patas and rhesus monkey populations on properties with a federal WS operational program?
- ♦ Should human health and safety concerns be allowed to continue without a WS patas and rhesus monkey management program?
- ♦ Should nuisance patas and rhesus monkey issues be allowed to continue without a WS patas and rhesus monkey management program?
- ♦ Should patas and rhesus monkey impacts on native wildlife be allowed to continue without a WS patas and rhesus monkey management program?
- ♦ Should patas and rhesus monkey impacts on agriculture be allowed to continue without a WS patas and rhesus monkey management program?
- ♦ If so, how should WS fulfill its legal responsibilities to protect natural resources, agriculture, and human health and safety in Puerto Rico?
- ♦ Would the proposed action have significant impacts requiring an EIS analysis?

#### **1.5 SCOPE OF THIS EA ANALYSIS**

**Actions Analyzed.** This EA evaluates planned feral and free-ranging patas and rhesus monkey damage management to protect human health and safety, reduce damage to agricultural resources, alleviate nuisance issues, and protect native wildlife in the Commonwealth of Puerto Rico and its satellite islands (including, but not limited to Desecheo, Cayo Santiago, Mona, Vieques, Culebra, etc.). Additional NEPA documentation would be required to conduct wildlife damage management that is outside the scope of this EA, should the need arise.

**Period for Which this EA is Valid.** This EA would remain valid until WS and other appropriate agencies determine that new needs for action, changed conditions or new alternatives having different environmental effects must be analyzed. At that time, this analysis and document would be supplemented pursuant to NEPA. Review of the EA would be conducted each year at the time of the wildlife damage management work planning process by the WS, Puerto Rico Department Environmental and Natural Resources (DRNA), Puerto Rico Department of Agriculture, U.S. Fish and Wildlife Service

(USFWS), and the U.S. Forest Service (USFS) and other appropriate agencies and/or entities to ensure that the EA is sufficient.

**Site Specificity.** This EA analyzes potential effects of WS's feral and free-ranging patas and rhesus monkey damage management activities that will occur or could occur at private and public property sites or facilities within the Commonwealth of Puerto Rico and its satellite islands (including, but not limited to Desecheo, Cayo Santiago, Mona, Vieques, Culebra, etc.) under MOUs, Cooperative Agreements, WS work plans or other comparable documents, and in cooperation with the appropriate land management agencies. It also addresses the impacts of management actions in areas where additional agreements may be signed in the future. Because the proposed action is to reduce damage and because the program's goals and directives are to provide services when requested, within the constraints of available funding and workforce, it is conceivable that additional feral and free-ranging patas and rhesus monkey damage management efforts could occur. Thus, this EA anticipates this potential expansion and analyzes the impacts of such efforts as part of the program.

Planning for the management of monkey damage must be viewed as being conceptually similar to federal or other agency actions whose missions are to stop or prevent adverse consequences from anticipated future events for which the actual sites and locations where they will occur are unknown but could be anywhere in a defined geographic area. Examples of such agencies and programs include fire and police departments, emergency clean-up organizations, insurance companies, etc. Although some of the sites where monkey damage will occur can be predicted, all specific locations or times where such damage will occur in any given year cannot be predicted. The EA emphasizes important issues as they relate to specific areas whenever possible. However, the issues that pertain to the various types of monkey damage and resulting management are the same, for the most part, wherever they occur, and are treated as such. The standard WS Decision Model (Slate et al. 1992) and WS Directive 2.105 is the routine thought process that is the site-specific procedure for determining methods and strategies to use or recommend for individual actions conducted by WS in the Commonwealth of Puerto Rico (See USDA 1997 and Chapter 2 for a more complete description of the WS Decision Model as well as examples of its application). Decisions made using this thought process will be in accordance with any mitigation measures and standard operating procedures described herein and adopted or established as part of the decision.

The analyses in this EA are intended to apply to any action that may occur *in any locale* and at *any time* within the Commonwealth. In this way, APHIS-WS believe it meets the intent of NEPA with regard to site-specific analysis and that this is the only practical way for WS to comply with NEPA and still be able to accomplish its mission.

**Summary of Public Involvement.** Issues related to the proposed action were initially developed by an interdisciplinary team process involving the Puerto Rico Department of Environmental and Natural Resources (DRNA). A Multi-agency Team of WS, DNER, USFWS, USDA – Veterinary Services personnel refined these issues, prepared objectives and identified preliminary alternatives. Potential environmental impacts of the Proposed Action and Alternatives in relation to these issues are discussed in Chapter 4.

As part of this process, and as required by the Council on Environmental Quality (CEQ) and APHIS-NEPA implementing regulations, this document and its Decision are being made available to the public through "Notices of Availability" (NOA) published in local media and through direct mailings of NOA to parties that have specifically requested to be notified. New issues or alternatives raised after publication

of public notices will be fully considered to determine whether the EA and its Decision should be revisited and, if appropriate, revised.

## **1.6 AUTHORITY AND COMPLIANCE**

### **1.6.1 Authority of Federal Agencies in Wildlife Damage Management in Puerto Rico**

#### **Wildlife Services Legislative Authority - Act of 1931.**

The USDA is directed by law to protect American agriculture and other resources from damage associated with wildlife. The primary statutory authority for the Wildlife Services program is the Act of 1931 (7 U.S.C. 426-426c; 46 Stat. 1468), as amended in the Fiscal Year 2001 Agriculture Appropriations Bill, which provides that:

*“The Secretary of Agriculture may conduct a program of wildlife services with respect to injurious animal species and take any action the Secretary considers necessary in conducting the program. The Secretary shall administer the program in a manner consistent with all wildlife services authorities in effect on the day before the date of the enactment of the Agriculture, Rural Development, Food and Drug Administration, and Related Agencies Appropriations Act, 2001.”*

Since 1931, with the changes in societal values, WS policies and programs place greater emphasis on the part of the Act discussing “*bringing (damage) under control*”, rather than “*eradication*” and “*suppression*” of wildlife populations. In 1988, Congress strengthened the legislative mandate of WS with the Rural Development, Agriculture, and Related Agencies Appropriations Act. This Act states, in part:

*“That hereafter, the Secretary of Agriculture is authorized, except for urban rodent control, to conduct activities and to enter into agreements with States, local jurisdictions, individuals, and public and private agencies, organizations, and institutions in the control of nuisance mammals and birds and those mammal and bird species that are reservoirs for zoonotic diseases, and to deposit any money collected under any such agreement into the appropriation accounts that incur the cost to be available immediately and to remain available until expended for Animal Damage Control activities.”*

#### **U.S. Department of Interior, Fish and Wildlife Service Legislative Mandate.**

The U. S. Fish and Wildlife Service’s (USFWS) authority for action is based on the Migratory Bird Treaty Act of 1918 (as amended), which implements treaties with the United States, Great Britain (for Canada), the United Mexican States, Japan, and the Soviet Union. Section 3 of this Act authorized the Secretary of Agriculture:

*“From time to time, having due regard to the zones of temperature and distribution, abundance, economic value, breeding habits, and times and lines of migratory flight of such birds, to determine when, to what extent, if at all, and by what means, it is compatible with the terms of the convention to allow hunting, taking, capture, killing, possession, sale, purchase, shipment, transportation, carriage, or export of any such bird, or any part, nest, or egg thereof, and to adopt suitable regulations permitting and governing the same, in accordance with such determinations, which regulations shall become effective when approved by the President”.*

The authority of the Secretary of Agriculture with respect to the Migratory Bird Treaty was transferred to the Secretary of the Interior in 1939 pursuant to Reorganization Plan No. II. Section 4(f), 4 Fed. Reg. 2731, 53 Stat. 1433.

**CFR 50 Subchapter C - The National Wildlife Refuge System - Part 30 - Feral Animals - Subpart B-30.11 - Control of feral animals.**

(a) Feral animals, including horses, burros, cattle, swine, sheep, goats, reindeer, dogs, and cats, without ownership that have reverted to the wild from a domestic state may be taken by authorized Federal or state personnel or by private persons operating under permit in accordance with applicable provisions of Federal or State law or regulation.

**U.S. Department of Interior, National Park Service Legislative Mandate.**

The primary statutory authority for the National Park Service is provided in the *National Park Service Organic Act of 1916*. Through this act, Congress established the National Park Service and mandated that it "shall promote and regulate the use of the federal areas known as national parks, monuments, and reservations...by such means and measures as conform to the fundamental purpose of the said parks, monuments, and reservations, which purpose is to conserve the scenery and the natural and historic objects and the wild life therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations." The Organic Act authorizes the Secretary to promulgate rules and regulations necessary for the management of the parks. This authority, among others, provides the basis for the regulations in 36 CFR 1.

**Endangered, Threatened, and Rare Species Management.** The National Park Service *Management Policies* 2000, Section 4.4.2.3 Management of Threatened or Endangered Plants and Animals, page 35, prescribes management of endangered, threatened, and candidate species and states that:

*"The Service will fully meet its obligations under the NPS Organic Act and the Endangered Species to both pro-actively conserve listed species and prevent detrimental effects on these species. To meet these obligations, the Service will...Undertake active management programs to...control detrimental non-native species..."*

*The Service will determine all management actions for the protection and perpetuation of federally, state, or locally listed species through the park management planning process, and will include consultation with lead federal and state agencies as appropriate."*

**Exotic Species Management.** National Park Service *Management Policies* 2001 addresses exotic species management on page 37 in **Section 4.4.4.1 Introduction or Maintenance of Exotic Species** where it states that: "In general, new exotic species will not be introduced or maintained to meet specific, identified management needs when all feasible and prudent measures to minimize the risk of harm have been taken... Furthermore, **Section 4.4.4.2 Removal of Exotic Species Already Present** states that: "All exotic plant and animal species that are not maintained to meet an identified park purpose will be managed - up to and including eradication - if (1) control is prudent and feasible, and (2) the exotic species:

- Interferes with natural processes and the perpetuation of natural features, native species or natural habitats; or
- Disrupts the genetic integrity of native species; or
- Disrupts the accurate presentation of a cultural landscape; or
- Damages cultural resources; or Significantly hampers the management of park or adjacent lands; or
- Poses a public health hazard as advised the U.S. Public Health Service (which includes the Centers for Disease Control and the NPS Public Health Program); or
- Creates a hazard to public safety.”

#### **1.6.2 Compliance with Other Federal and Commonwealth of Puerto Rico Laws, Rules, and Regulations**

Several federal laws, state laws, and state regulations regulate WS wildlife damage management. WS complies with these laws and regulations, and consults and cooperates with other agencies as appropriate.

#### **THE CONSTITUTION OF THE COMMONWEALTH OF PUERTO RICO. ARTICLE VI. GENERAL PROVISIONS**

PR CONST Art. VI, <section> 19  
Puerto Rico Const. Art. VI, <section> 19

#### **LAWS OF PUERTO RICO ANNOTATED THE CONSTITUTION OF THE COMMONWEALTH OF PUERTO RICO ARTICLE VI. GENERAL PROVISIONS**

*Section 19.* [Natural resources; historic or artistic sites; penal institutions; delinquents]  
It shall be the public policy of the Commonwealth to conserve, develop and use its natural resources in the most effective manner possible for the general welfare of the community; to conserve and maintain buildings and places declared by the Legislative Assembly to be of historic or artistic value; to regulate its penal institutions in a manner that effectively achieves their purposes and to provide, within the limits of available resources, for adequate treatment of delinquents in order to make possible their moral and social rehabilitation.

#### **LAWS OF PUERTO RICO ANNOTATED. TITLE THREE. Executive**

#### **CHAPTER 10. Department of Natural and Environmental Resources**

##### *Section 162.* Implementation of programs

All programs administered by the Department of Natural and Environmental Resources and the faculties herein conferred to its Secretary shall be implemented in accordance with the established environmental public policy.

##### *Section 153.* Responsibility

The Department of Natural and Environmental Resources shall be responsible for implementing, with respect to the operational phase, the public policy of the Commonwealth of Puerto Rico contained in <section> 19 of Article VI of the Constitution by the Board on Environmental Quality in accordance with <section><section> 1121- 1140 of Title 12. To such effects it shall place in force programs for the use and conservation of the natural resources of Puerto Rico, always within the standards established by the Board on Environmental Quality.

*Section 155. Functions and duties of Secretary*

The Secretary of Natural Resources shall have, in addition to those transferred hereby, the following faculties and duties:

- (a) To advise and make recommendations to the Governor, to the Legislature and to other organizations of the government with respect to the implementation of the public policy on natural resources.
- (b) To establish the internal organization of the Department, and to appoint in accordance with the applicable laws, the necessary personnel for its operation.
- (c) To appoint a subsecretary who shall fulfill the functions that the Secretary may assign to him and who shall substitute for him in case of a provisional vacancy.
- (d) To adopt, amend and repeal regulations to carry out the objectives of this chapter, in accordance with <section><section> 1041-1059 of this title.
- (e) To enter into necessary and convenient compacts or agreements for the purposes of attaining the goals of the Department and its programs, with the organizations of the Government of the United States of America, with the commonwealth governments, with other departments, agencies or instrumentalities of the Government of the Commonwealth and with private institutions; he is likewise empowered to accept and receive any donations or funds by means of appropriations, advances or any other type of aid or benefit when derived from said government organizations or from nonprofit institutions.
- (f) To appoint those commissions, boards and committees that he may deem necessary for the better attainment of the goals of this chapter, as well as to collaborate with any entities related with the goals and purposes of the department, offering therefore the secretarial services or technical assistance that they may need. In the appointment of these commissions, boards, and committees the Secretary shall give careful attention so that there be encouraged and offered ample opportunity for the participation of the citizens.
- (g) To establish through regulations to such effects, the fees paid for permits for the sinking of wells for the pumping of subterranean waters in public and private lands in accordance with the faculties transferred by subsection (h) of <section> 156 of this title, to control the use and extraction of subterranean waters, to fix its extraction rhythm and to establish the fees to be paid for the subterranean waters to be extracted from the wells in public or private lands.

(h) To exercise surveillance and see to the conservation of territorial waters, submerged lands thereunder and the maritime-terrestrial zone, to grant franchises, permits and licenses of public nature for its use and exploitation and to establish through regulations the fees to be paid by same. To such effects he shall be empowered to exercise such powers and faculties that may be delegated by any agency or instrumentality of the federal government under any act of the Congress of the United States.

(i) To take all the necessary measures for the conservation, preservation, distribution, management, introduction, propagation, and restoration of terrestrial as well as aquatic resident, migratory, and exotic wildlife, animal, and plant species in the Commonwealth of Puerto Rico, providing that the designation of sanctuaries is excluded from the above.

(j) To carry out investigations in order to obtain information about the population, distribution, habitat needs, limiting factors and other biological and ecological data to determine the conservation measures needed for the support and survival of the wildlife, animal and plant species mentioned in subsection (i) of this section.

(k) To acquire, through purchase, donation, transfer, or any other lawful means, appropriate land and aquatic habitats for the species indicated in subsection (i) of this section.

(l) Faculty to adopt regulations in order to designate, improve and preserve the terrestrial as well as aquatic wildlife, animal and plant species, that are threatened or endangered in the Commonwealth of Puerto Rico; expressly provided the right of the citizens to take part in the process of public hearings that must be conducted to such effects.

(m) Faculty to establish, construct, develop, operate and maintain recreational areas, structures and facilities on the land under his custody and administration; and to fix the fees and rates to be charged for these services. This will be done with the approval of the Secretary of Sports and Recreation. The income derived from these activities shall be deposited in a Special Fund to be used for the maintenance and operation of these areas.

(n) To fix and collect, through regulations to these effects, the corresponding fees for copies of publications, studies, reports, maps, plans, photographs and any other document of a public nature that are requested of him. The income derived from this service shall be covered into a Special Fund within the Department. However, the Secretary, or the person upon whom he delegates this faculty, shall provide free copies to the Legislative, Judicial and Executive Branches, as well as to the Municipal Governments, and, at his discretion, to the persons or entities that he considers convenient.

(o) Faculty to regulate the recreational and sports use of cross-country motor vehicles (C.C.V.) such as: automobiles, motorcycles, four-wheel traction vehicles and "dune buggies", on public land. These regulations shall be drafted and adopted in conjunction with the Department of Transportation and Public Works, and the Secretary of Sports and Recreation. The Secretary of the Department of Natural and



Environmental Resources, in conjunction with the C.C.V. Federations and Associations of Puerto Rico, shall designate specific areas for the recreational and sports use of cross-country motor vehicles. The income derived as a result of these regulations shall be deposited in a Special Fund designated to the maintenance and operation of the activities and management programs that are thus established.

*Section 158. Penalties; administrative hearings*

(a) Any violation of this chapter or of the regulations promulgated hereunder shall constitute a misdemeanor and upon conviction the accused shall be punished with a fine of not less than fifty (50) dollars, nor more than five hundred (500) dollars, or imprisonment for a term of not less than five (5) days nor more than ninety (90) days, or both penalties, at the discretion of the court.

(b) The Secretary of the Department of Natural and Environmental Resources is hereby empowered to impose administrative fines for damage caused to wildlife, animal and plant species or for the violation of any of the provisions of this chapter or of the regulations and measures adopted by the Secretary thereunder, after holding an administrative hearing. The Secretary of Natural and Environmental Resources shall fix, through regulations to such effect, the amounts that shall be paid, as administrative fines, for each illegal act committed in violation of the provisions of this section. The administrative fines shall not exceed five thousand (5,000) dollars for each illegal act committed. Each violation of this chapter or its regulations shall be considered as a separate violation and shall be subject to an administrative fine up to the previously-established maximum.

(c) In the event of subsequent violations to this section, the Secretary of Natural and Environmental Resources, in the exercise of his discretion, may impose an additional administrative fine, up to a maximum of ten thousand (10,000) dollars.

(d) The Secretary of Natural and Environmental Resources shall determine the date, time and place that the administrative hearing, referred to in subsection (b) of this section, shall be held; and shall notify the interested party thereof by certified mail, with return receipt requested, to his last known address. The interested party may appear at said hearing *motu proprio* or represented by a lawyer. To the effects of the administrative hearing authorized herein, the Secretary of Natural and Environmental Resources may order the appearance and testimony of witnesses, the introduction of all evidence that he considers pertinent, and the administering of oaths and the admission of testimony. When a summons of the Secretary is disobeyed, he may go before the court for a judicial order requiring compliance with the summons to be issued. Any disobedience of the court order may be punished as contempt by the court. The Secretary shall issue a resolution within thirty (30) days following the holding of the hearing, and notice to the interested party to his last known address. The Secretary shall include in his resolution a description of the illegal act, or acts, for the commission of which an administrative fine is imposed. The party affected by the Secretary's decision may request, in writing, a reconsideration of the same within ten (10) days following the date of notice of the decision. This request for reconsideration shall be resolved by the Secretary within fifteen (15) days following the date of notice thereof. The party affected by a reconsidered decision may file an appeal for review before the Court of First Instance, within ten (10) days after date of notice of such

decision. Once the appeal is filed the petitioner must notify the Secretary thereof within a term of five (5) days counting from its filing.

The Secretary shall take to court, within the term fixed by it, a certified copy of the complete record of the administrative procedure. The request for reconsideration or the intervention of an appeal referred to in this subsection will not stay the effects of the Secretary's order or resolution.

**LAWS OF PUERTO RICO ANNOTATED. TITLE TWELVE. Conservation**  
**Subtitle 5. Environment**

**CHAPTER 121. Conservation of Environment and Natural Resources**  
**SUBCHAPTER I. Declaration of Environmental Public Policy**

*Section 1124. Interpretation of legal provisions*

It is authorized that, to the fullest extent possible, all policies and public laws in force be interpreted, applied, and administered in strict accordance with the public policy set forth in <section><section> 1121-1140a of this title. All departments, agencies, public corporations, municipalities and instrumentalities of the Commonwealth of Puerto Rico and its political subdivisions are likewise directed, on the appliance of section><section> 1121-1140a of this title, to comply with the following regulations:

- (a) Use an interdisciplinary system of approach which shall guarantee the integrated use of [the] natural and social sciences and of the art of "artistic natural embellishment" [for] making plans and decisions which might produce an impact on man's environment.
- (b) Identify and develop methods and procedures, in consultation with the Board on Environmental Quality, established under <section><section> 1128-1140a of this title; guarantee not only the consideration of technical and economic elements, but also those elements referring to established values and amenities even though not measured and evaluated economically.
- (c) Include in every recommendation or report on proposed legislation and issue, before performing any action or advertising any governmental decision which significantly affect the environmental quality, a written and detailed statement for:
  - (1) The environmental impact of the proposed legislation, of the action to be performed or [of] the decision to be promulgated;
  - (2) any adverse environmental effects which cannot be avoided should the proposal be implemented, should the action be performed or the governmental decision promulgated;
  - (3) alternatives to the proposed legislation, or the action or governmental decision in consideration;
  - (4) the relation between local short-term uses of man's environment and the maintenance and improvement of long-term productivity, and

(5) any irrevocable or irreparable commitment of the resources that would be involved in the proposed legislation, if the same were implemented, in the government action if it were made or in the decision if promulgated.

Before the concerned body includes or issues the corresponding environmental impact statement, the official responsible for the same, shall consult and obtain the opinion of the proposed legislation, the action to be taken or the government decision to be promulgated, that any other government body with jurisdiction or influence on the environmental impact of said legislation, action or decisions could have.

Concerning those cases whereby the Government of Puerto Rico adopts long-term plans for the development of public infrastructure, in particular, but not limited only to those transportation projects that are contemplated in the highway plans of the Planning Board, it is hereby acknowledged that the projects associated with said plans may be carried out by stages, as public policy and resources may allow. The agencies and instrumentalities of the Government of Puerto Rico must submit the corresponding environmental impact statements before proceeding with the construction of any of said stages. Copies of said environmental impact statements and [of] the opinions of the entities consulted shall be made available to the Environmental Quality Board, the Governor and the legislative bodies. They shall furthermore be available to the public and shall accompany the legislative proposal, action or decision regarding the corresponding examinations and study processes conducted through the government entities.

The official responsible for issuing the environmental impact statement shall hand an electronically reproduced copy [in] the format established by the Environmental Quality Board. The Environmental Quality Board shall publish said environmental impact statement electronically through an easily accessible and cost-free medium, such as [an] Internet website. The electronic publication of the environmental impact statement and its public availability, shall coincide with the date this document is available to the public on hard copy.

The Environmental Quality Board is hereby empowered to implement the provisions of this subsection and to recover from the proponent the actual cost of the process of electronic publication.

(d) Study, develop and describe the proper alternatives for the course of action recommended in any proposal which involves irresolute conflicts in regard to alternate uses of the available resources.

(e) Recognize the worldwide and long-term character of environmental problems, and where it harmonizes with the foreign policy of the United States, to offer the proper support to initiatives, resolutions and programs designed to carry out, to the maximum, international cooperation [for] anticipating and avoiding [the] deterioration [of] the quality of humanity's worldwide environment.

(f) Offer [to] municipalities, institutions and individuals, useful advice and information [on] the restoration, conservation and improvement of environmental quality.

(g) Initiate and use ecologic[al] information in the [planning] and development of directed resource projects.

(h) Aid the Board on Environmental Quality established under <section> <section> 1128 a 1140a of this title.

#### *Section 1135. Character of Board for federal purposes*

The Board on Environmental Quality is hereby designated as the agency of the Commonwealth of Puerto Rico authorized to exercise, execute, receive and administer the delegation, establish regulations and implement a permit system related to, but not limited to: the Federal Clean Water Act, Federal Clean Air Act, Federal Solid Waste Disposal Act, Federal Resource Conservation and Recovery Act, Federal Comprehensive Environmental Response, Compensation and Liability Act, as amended, and for the purposes of any other federal legislation that might be passed in the future by the Congress of the United States related to the conservation of the environment and natural resources, solid waste and others related to the purposes of <section><section> 1121-1140a of this title.

#### **National Environmental Policy Act (NEPA).**

Environmental documents pursuant to NEPA must be completed before operational activities consistent with the NEPA decision can be implemented. This EA meets the NEPA requirement for the proposed action in the Commonwealth of Puerto Rico. When WS direct management assistance is requested by another federal agency, NEPA compliance is the responsibility of the other federal agency. However, WS could agree to complete NEPA documentation at the request of the other federal agency. WS also coordinates specific projects and programs with other agencies. The purpose of these contacts is to coordinate any wildlife damage management that may affect resources managed by these agencies or affect other areas of mutual concern.

#### **Endangered Species Act (ESA).**

It is federal policy, under the ESA, that all federal agencies shall seek to conserve endangered and threatened species and shall utilize their authorities in furtherance of the purposes of the Act [Sec. 7(a)(1)]. WS conducts Section 7 consultations with the FWS to use the expertise of the FWS to ensure that "any action authorized, funded or carried out by such an agency. . . is not likely to jeopardize the continued existence of any endangered or threatened species. . . Each agency shall use the best scientific and commercial data available" [Sec. 7(a)(2)]. WS obtained a Biological Opinion (B.O.) from the U.S. Fish and Wildlife Service describing potential effects on T&E species and prescribing reasonable and prudent measures for avoiding jeopardy (USDA 1997, Appendix F).

#### **Convention on International Trade in Endangered Species of Wild Fauna and Flora 1973 (CITES).**

CITES is an international agreement to which States (countries) adhere voluntarily. States that have agreed to be bound by the Convention ('joined' CITES) are known as Parties. Although CITES is legally binding on the Parties - in other words they have to implement the Convention -

it does not take the place of national laws. Rather it provides a framework to be respected by each Party, which has to adopt its own domestic legislation to make sure that CITES is implemented at the national level.

The USFWS is responsible for implementing and enforcing CITES on United States of America soil, air, and water. The USFWS does not regulate control of nonnative monkeys in Puerto Rico, unless it involves import or export (USFWS, Regional Environmental Coordinator Kevin Moody, per. comm., 2004). The authority and responsibility for managing nonnative species in the Commonwealth of Puerto Rico lies with the Department of Environmental and Natural Resources.

#### **Migratory Bird Treaty Act (MBTA).**

The MBTA provides the USFWS regulatory authority to protect species of birds that migrate outside the United States. The law prohibits any "take" of the species, except as permitted by the USFWS or by federal agencies within the scope of their authority; therefore the USFWS issues permits for managing wildlife damage situations.

#### **Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA).**

FIFRA requires the registration, classification, and regulation of all pesticides used in the United States. The United States Environmental Protection Agency (EPA) is responsible for implementing and enforcing FIFRA. The Commonwealth of Puerto Rico regulates pesticides through the Puerto Rico Department of Agriculture (PRDA), Agrologic Lab.

#### **Investigational New Animal Drug (INAD).**

The Food and Drug Administration (FDA) grants permission to use investigational new animal drugs [21 Code of Federal Regulations (CFR), Part 511].

**Animal Welfare Act (AWA).** The AWA requires that minimum standards of care and treatment be provided for certain animals bred for commercial sale, used in research, transported commercially, or exhibited to the public. Individuals who operate facilities in these categories must provide their animals with adequate care and treatment in the areas of housing, handling, sanitation, nutrition, water, veterinary care, and protection from extreme weather and temperatures. The USDA, Animal and Plant Health Inspection Service (APHIS) administers the AWA, its standards, and its regulations.

**Executive Order 13112 on Invasive Species.** Executive Order 13112 - Invasive Species directs Federal agencies to use their programs and authorities to prevent the spread or to control populations of invasive species that cause economic or environmental harm, or harm to human health. To comply with Executive Order 13112, WS may cooperate with other Federal, State, or Local government agencies, or with industry or private individuals to reduce damage to the environment or threats to human health and safety.

**The World Conservation Union (IUCN). Species Survival Commission (SSC) – IUCN Guidelines for the Prevention of Biodiversity Loss Caused by Alien Invasive Species.** The goal of these guidelines is to prevent further losses of biological diversity due to the deleterious effects of alien invasive species. The intention is to assist governments and management

agencies to give effect to Article 8 (h) of the Convention on Biological Diversity, which states that:

"Each Contracting Party shall, as far as possible and as appropriate:

...(h) Prevent the introduction of, control or eradicate those alien species which threaten ecosystems, habitats or species."

These guidelines draw on and incorporate relevant parts of the 1987 IUCN Position Statement on Translocation of Living Organisms although they are more comprehensive in scope than the 1987 Translocation Statement. The relationship to another relevant guideline, the IUCN Guidelines for Re-introductions, is elaborated in Section 7.

These guidelines are concerned with preventing loss of biological diversity caused by biological invasions of alien invasive species. They do not address the issue of genetically modified organisms, although many of the issues and principles stated here could apply. Neither do these guidelines address the economic (agricultural, forestry, aquaculture), human health and cultural impacts caused by biological invasions of alien invasive species.

These guidelines address four substantive concerns of the biological alien invasion problem that can be identified from this background context. These are:

- \* improving understanding and awareness;
- \* strengthening the management response;
- \* providing appropriate legal and institutional mechanisms;
- \* enhancing knowledge and research efforts.

While addressing all four concerns is important, these particular guidelines focus most strongly on aspects of strengthening the management response. This focus reflects the urgent need to spread information on management that can quickly be put into place to prevent alien invasions and eradicate or control established alien invasives. Addressing the other concerns, particularly the legal and research ones, may require longer-term strategies to achieve the necessary changes.

These guidelines have the following seven objectives.

1. To increase awareness of alien invasive species as a major issue affecting native biodiversity in developed and developing countries and in all regions of the world.
2. To encourage prevention of alien invasive species introductions as a priority issue requiring national and international action.
3. To minimize the number of unintentional introductions and to prevent unauthorized introductions of alien species.
4. To ensure that intentional introductions, including those for biological control purposes, are properly evaluated in advance, with full regard to potential impacts on biodiversity.
5. To encourage the development and implementation of eradication and control campaigns and programmes for alien invasive species, and to increase the effectiveness of those campaigns and programmes.
6. To encourage the development of a comprehensive framework for national legislation and international cooperation to regulate the introduction of alien species as well as the eradication and control of alien invasive species.

7. To encourage necessary research and the development and sharing of an adequate knowledge base to address the problem of alien invasive species worldwide.

### 3. DEFINITION OF TERMS (2)

**"Alien invasive species"** means an alien species which becomes established in natural or semi-natural ecosystems or habitat, is an agent of change, and threatens native biological diversity.

**"Alien species"** (non-native, non-indigenous, foreign, exotic) means a species, subspecies, or lower taxon occurring outside of its natural range (past or present) and dispersal potential (i.e. outside the range it occupies naturally or could not occupy without direct or indirect introduction or care by humans) and includes any part, gametes or propagule of such species that might survive and subsequently reproduce.

**"Biological diversity"** (biodiversity) means the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are a part; this includes diversity within species, between species and of ecosystems.

**"Biosecurity threats"** means those matters or activities which, individually or collectively, may constitute a biological risk to the ecological welfare or to the well-being of humans, animals or plants of a country.

**"Government"** includes regional co-operating groupings of governments for matters falling within their areas of competence.

**"Intentional introduction"** means an introduction made deliberately by humans, involving the purposeful movement of a species outside of its natural range and dispersal potential. (Such introductions may be authorized or unauthorized.)

**"Introduction"** means the movement, by human agency, of a species, subspecies, or lower taxon (including any part, gametes or propagule that might survive and subsequently reproduce) outside its natural range (past or present). This movement can be either within a country or between countries.

**"Native species"** (indigenous) means a species, subspecies, or lower taxon, occurring within its natural range (past or present) and dispersal potential (i.e. within the range it occupies naturally or could occupy without direct or indirect introduction or care by humans.)

**"Natural ecosystem"** means an ecosystem not perceptibly altered by humans.

**"Re-introduction"** means an attempt to establish a species in an area which was once part of its historical range, but from which it has been extirpated or become extinct. (From IUCN Guidelines for Re-Introductions)

**"Semi-natural ecosystem"** means an ecosystem which has been altered by human actions, but which retains significant native elements.

**"Unintentional introduction"** means an unintended introduction made as a result of a species utilizing humans or human delivery systems as vectors for dispersal outside its natural range."

**Environmental Justice and Executive Order 12898. Federal Actions to Address Environmental Justice in Minority Populations and Low - Income Populations.**

Environmental Justice has been defined as the pursuit of equal justice and equal protection under the law for all environmental statutes and regulations without discrimination based on race, ethnicity, or socioeconomic status. Executive Order 12898 requires Federal agencies to make Environmental Justice part of their mission, and to identify and address disproportionately high and adverse human health and environmental effects of Federal programs, policies and activities on minority and low-income persons or populations. A critical goal of Executive Order 12898 is to improve the scientific basis for decision-making by conducting assessments that identify and prioritize environmental health risks and procedures for risk reduction. Environmental Justice is a priority both within the APHIS and WS. APHIS plans to implement Executive Order 12898 principally through its compliance with the provisions of NEPA.

WS activities are evaluated for their impact on the human environment and compliance with Executive Order 12898 to ensure Environmental Justice. WS personnel use wildlife damage management methods as selectively and environmentally conscientiously as possible. All chemicals used by APHIS-WS are regulated by the EPA through the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA), FDA, PRDA, Memorandum Of Understanding (MOU) with Federal natural resource managing agencies, and by WS Directives. Based on a thorough Risk Assessment, APHIS concluded that when WS program chemicals are used following label directions, they are highly selective to target individuals or populations, and such use has negligible impacts on the environment (USDA 1997, Appendix P). The WS operational program properly disposes of any excess solid or hazardous waste. It is not anticipated that the proposed action would result in any adverse or disproportionate environmental impacts to minority and low-income persons or populations. In contrast, the proposed action may benefit minority or low-income populations by reducing monkey damage such as threats to public health and safety.

**The Native American Graves and Repatriation Act of 1990.** The Native American Graves Protection and Repatriation Act requires federal agencies to notify the Secretary of the Department that manages the federal lands upon the discovery of Native American cultural items on federal or tribal lands. Federal projects would discontinue work until a reasonable effort has been made to protect the items and the proper authority has been notified.

**National Historic Preservation Act (NHPA) of 1966 as amended.** The NHPA of 1966, and its implementing regulations (36 CFR 800), requires federal agencies to: 1) determine whether activities they propose constitute "undertakings" that has the potential to cause effects on historic properties and, 2) if so, to evaluate the effects of such undertakings on such historic resources and consult with the Advisory Council on Historic Preservation (i.e. State Historic Preservation Office, Tribal Historic Preservation Officers), as appropriate. WS actions on tribal lands are only conducted at the tribe's request and under signed agreement; thus, the tribes have control over any potential conflict with cultural resources on tribal properties.

Each of the wildlife damage management methods described in this EA that might be used operationally by WS do not cause major ground disturbance, do not cause any physical destruction or damage to property, do not cause any alterations of property, wildlife habitat, or landscapes, and do not involve the sale, lease, or transfer of ownership of any property. In general, such methods also do not have the potential to introduce visual, atmospheric, or audible elements to areas in which they are used that could result in effects on the character or use of



historic properties. Therefore, the methods that would be used by WS under the proposed action are not generally the types of activities that would have the potential to affect historic properties. If an individual activity with the potential to affect historic resources is planned under an alternative selected as a result of a decision on this EA, then site-specific consultation as required by Section 106 of the NHPA would be conducted as necessary.

There is potential for audible effects on the use and enjoyment of a historic property when methods such as firearms are used at or in close proximity to such sites for purposes of removing animals. However, such methods would only be used at a historic site at the request of the owner or manager of the site to resolve a damage or nuisance problem, which means such use would be to benefit the historic property. A built-in mitigating factor for this issue is that virtually all of the methods involved would only have temporary effects on the audible nature of a site and can be ended at any time to restore the audible qualities of such sites to their original condition with no further adverse effects. Site-specific consultation as required by Section 106 of the NHPA would be conducted as necessary in those types of situations.

**Protection of Children from Environmental Health and Safety Risks (Executive Order 13045).** Children may suffer disproportionately from environmental health and safety risks for many reasons, including their development physical and mental status. Because WS makes it a high priority to identify and assess environmental health and safety risks that may disproportionately affect children, WS has considered the impacts that this proposal might have on children. The proposed monkey damage management program would only occur by using legally available and approved methods where it is highly unlikely that children would be adversely affected. For these reasons, WS concludes that it would not create an environmental health or safety risk to children from implementing this proposed action.

**Federal Food, Drug, and Cosmetic Act (21 U.S.C. 360).** This law places administration of pharmaceutical drugs, including those used in wildlife capture and handling, under the Food and Drug Administration (FDA). The Commonwealth of Puerto Rico counterpart to FDA is "Administracion de Servicios de Salud Mental y Contra la Adiccion" (AMSCA).

**Controlled Substances Act of 1970 (21 U.S.C. 821 et seq.).** This law requires an individual or agency to have a special registration number from the federal Drug Enforcement Administration (DEA) to possess controlled substances, including those that are used in wildlife capture and handling.

**Animal Medicinal Drug Use Clarification Act of 1994 (AMDUCA).** The AMDUCA and its implementing regulations (21 CFR Part 530) establish several requirements for the use of animal drugs, including those used to capture and handle wildlife in rabies management programs. Those requirements are: (1) a valid "veterinarian-client-patient" relationship, (2) well defined record keeping, (3) a withdrawal period for animals that have been administered drugs, and (4) identification of animals. A veterinarian, either on staff or on an advisory basis, would be involved in the oversight of the use of animal capture and handling drugs under the proposed action. Veterinary authorities in each state have the discretion under this law to establish withdrawal times (i.e., a period of time after a drug is administered that must lapse before an animal may be used for food) for specific drugs. Animals that might be consumed by a human within the withdrawal period must be identified; the Western Wildlife Health Committee of the Western Association of Fish and Wildlife Agencies has recommended that suitable identification markers include durable ear tags, neck collars, or other external markers that provide unique

identification (WWHC *undated*). APHIS-WS establishes procedures in each state for administering drugs used in wildlife capture and handling that must be approved by state veterinary authorities in order to comply with this law.

## **1.7 A PREVIEW OF THE REMAINING CHAPTERS IN THIS EA**

This EA is composed of five chapters and two appendices. Chapter 2 discusses and analyzes the issues and affected environment. Chapter 3 contains a description of each alternative, alternatives not considered in detail, and mitigation and SOPs. Chapter 4 analyzes the environmental impacts associated with each alternative considered in detail. Chapter 5 contains the list of preparers of this EA. Appendix A is the literature cited in the EA and Appendix B is the glossary of the EA.

## **CHAPTER 2: ISSUES AND AFFECTED ENVIRONMENT**

### **INTRODUCTION**

Chapter 2 contains a discussion of the issues, including those that will receive detailed environmental impacts analysis in Chapter 4 (Environmental Consequences) that were used to develop mitigation measures and SOPs in Chapter 3, and the issues that will not be considered in detail with rationale. Pertinent portions of the affected environment will be included in this chapter in the discussion of issues used to develop mitigation measures. Additional affected environments will be incorporated into the discussion of the environmental impacts in Chapter 4.

Issues are concerns of the public and/or of professional communities about potential environmental problems that might occur from a proposed federal action. Such issues must be considered in the NEPA decision process. Issues relating to the management of wildlife damage were raised during the scoping process in preparing the programmatic ADC FEIS (USDA 1997) and were considered in the preparation of this EA. These issues are fully evaluated within the FEIS, which analyzed specific data relevant to the WS Program in Puerto Rico.

### **2.1 AFFECTED ENVIRONMENT**

The areas of the proposed action include urban and rural areas where feral and free-ranging patas and rhesus monkeys are of concern to landowners, city managers, and/or resource managers. Control areas may include federal, state, county, city, private, or other lands, where WS assistance has been requested by a landowner or manager to control feral and free-ranging monkeys to protect human health and safety, agriculture, alleviate nuisance issues, and reduce impacts to wildlife species. The control areas would also include property in or adjacent to identified sites where feral and free-ranging patas and rhesus monkey activities posed a threat to human health and safety. Feral and free-ranging monkey damage control would be conducted when requested by a landowner or manager, and only on properties with a Cooperative Agreement with Wildlife Services.

### **2.2 ISSUES ADDRESSED IN DETAIL IN CHAPTER 4**

Following are issues that have been identified as areas of concern requiring consideration in this EA.

- ◆ Effects of Feral and Free-Ranging Patas and Rhesus monkeys on Human Health and Safety, Agriculture, Nuisance, and Native Wildlife
- ◆ Effects on Target Species Populations
- ◆ Effects of Control Methods on Nontarget Species Populations, Including T&E Species
- ◆ Humaneness of Control Methods
- ◆ Effects of Control Methods on Human Health and Safety
- ◆ Effects on the Aesthetic Values of Targeted Species and Protected T&E Species

#### **2.2.1 Effects of Feral and Free-Ranging Patas and Rhesus Monkeys on Human Health and Safety, Agriculture, Nuisance, and Native Wildlife**

Some people are concerned about the threats to human health and safety, and nuisance issues created by feral and free-ranging patas and rhesus monkey populations in urban and rural areas. Other people are concerned with the potential impacts of patas and rhesus monkey populations on agricultural resources and native wildlife within the Commonwealth of Puerto Rico, especially Endangered, Threatened, Species of Special Concern (T&E). There is concern that

the monkeys may pose a substantial threat to some species of native wildlife (i.e. yellow-shouldered blackbird). These publics are concerned as to whether the proposed action or any of the alternatives would reduce such damage, as described, to acceptable levels.

### **2.2.2 Effects on Target Species Populations**

Some persons are concerned that the proposed action or any of the alternatives would result in the loss of patas and rhesus monkeys as species in the wild (native populations in Africa and Asia) or could have a cumulative adverse impact on native patas and rhesus monkey populations. Furthermore, some persons are concerned that the proposed action or any of the alternatives would result in adverse impacts to patas and rhesus monkeys used for research.

### **2.2.3 Effects of Control Methods on Nontarget Species Populations, Including T&E Species**

A common concern among members of the public and wildlife professionals, including WS personnel, is the potential for control methods used in the proposed action or any of the alternatives to inadvertently capture or remove nontarget animals or potentially cause adverse impacts to nontarget species populations, particularly T&E species and indoor pets. WS's mitigation and SOPs are designed to reduce the effects on nontarget species' populations and are presented in Chapter 3. To reduce the risks of adverse affects to nontarget species, WS would select damage management methods that are as target-selective as possible or apply such methods in ways to reduce the likelihood of capturing nontarget species. Before initiating trapping, WS would select trapping locations which are extensively used by the target species and use baits or lures which are preferred by the target species.

Special efforts are made to avoid jeopardizing T&E species through biological evaluations of the potential effects and the establishment of special restrictions or mitigation measures. WS has consulted with the USFWS under Section 7 of the Endangered Species Act (ESA) concerning potential impacts of WDM methods on T&E species and has obtained a Biological Opinion (B.O.). For the full context of the B.O., see Appendix F of the ADC FEIS (USDA 1997, Appendix F). WS is also in the process of reinitiating Section 7 consultation at the program level to assure that potential effects on T&E species have been adequately addressed.

WS has reviewed the list of T&E species for Puerto Rico and has determined that WS monkey damage management activities will not likely adversely affect any species protected by the Puerto Rican Government or the United States Endangered Species Act. This determination was concurred by the Puerto Rican government and the USFWS.

### **The following species are listed by the USFWS as endangered or threatened in the Commonwealth of Puerto Rico:**

Puerto Rico (75 listings)

E=Endangered

T=Threatened

Animals -- 26

- |   |  |
|---|--|
| E | Anole, Culebra Island giant ( <i>Anolis roosevelti</i> )   |
| E | Blackbird, yellow-shouldered ( <i>Agelaius xanthomus</i> ) |

T	Boa, Mona ( <i>Epicrates monensis monensis</i> )
E	Boa, Puerto Rican ( <i>Epicrates inornatus</i> )
E	Boa, Virgin Islands tree ( <i>Epicrates monensis granti</i> )
T	Coqui, golden ( <i>Eleutherodactylus jasper</i> )
E	Gecko, Monito ( <i>Sphaerodactylus micropithecus</i> )
T	Guajon ( <i>Eleutherodactylus cooki</i> )
E	Hawk, Puerto Rican broad-winged ( <i>Buteo platypterus brunescens</i> )
E	Hawk, Puerto Rican sharp-shinned ( <i>Accipiter striatus venator</i> )
T	Iguana, Mona ground ( <i>Cyclura stejnegeri</i> )
E	Manatee, West Indian ( <i>Trichechus manatus</i> )
E	Nightjar, Puerto Rican ( <i>Caprimulgus noctitherus</i> )
E	Parrot, Puerto Rican ( <i>Amazona vittata</i> )
E	Pelican, brown ( <i>Pelecanus occidentalis</i> )
E	Pigeon, Puerto Rican plain ( <i>Columba inornata wetmorei</i> )
T	Plover, piping ( <i>Charadrius melodus</i> )
T	Sea turtle, green ( <i>Chelonia mydas</i> )
E	Sea turtle, hawksbill ( <i>Eretmochelys imbricata</i> )
E	Sea turtle, leatherback ( <i>Dermochelys coriacea</i> )
T	Sea turtle, loggerhead ( <i>Caretta caretta</i> )
E	Seal, Caribbean monk ( <i>Monachus tropicalis</i> )
T	Tern, roseate ( <i>Sterna dougallii dougallii</i> )
T	Toad, Puerto Rican crested ( <i>Peltophryne lemur</i> )
E	Whale, finback ( <i>Balaenoptera physalus</i> )
E	Whale, sperm ( <i>Physeter catodon</i> (=macrocephalus))

#### Plants -- 49

E	<i>Adiantum vivesii</i> (No common name)
E	<i>Aristida chaseae</i> (No common name)
E	Pelos del diablo ( <i>Aristida portoricensis</i> )
E	<i>Auerodendron pauciflorum</i> (No common name)
E	Palo de ramon ( <i>Banara vanderbiltii</i> )
E	Boxwood, Vahl's ( <i>Buxus vahlii</i> )
E	Capa rosa ( <i>Callicarpa ampla</i> )
E	<i>Calyptanthus thomasi</i> (No common name)
T	Manaca, palma de ( <i>Calyptronoma rivalis</i> )
E	<i>Catesbaea melanocarpa</i> (No common name)
E	<i>Chamaecrista glandulosa</i> var. <i>mirabilis</i> (No common name)
E	<i>Cordia alliodora</i> (No common name)
E	Palo de nigua ( <i>Cornutia obovata</i> )
E	<i>Cranichis ricartii</i> (No common name)
E	Higuero de sierra ( <i>Crescentia portoricensis</i> )
E	Fern, Elfin tree ( <i>Cyathea dryopteroides</i> )
E	<i>Daphnopsis hellerana</i> (No common name)
E	<i>Elaphoglossum serpens</i> (No common name)
E	Uvillo ( <i>Eugenia haematocarpa</i> )
E	<i>Eugenia woodburyana</i> (No common name)
T	<i>Gesneria pauciflora</i> (No common name)
E	Goetzea, beautiful ( <i>Goetzea elegans</i> )
T	Higo, chumbo ( <i>Harrisia portoricensis</i> )

E	Holly, Cook's ( <i>Ilex cookii</i> )
E	<i>Ilex sintenisii</i> (No common name)
E	Walnut, West Indian or nogal ( <i>Juglans jamaicensis</i> )
E	<i>Lepanthes eltoroensis</i> (No common name)
E	<i>Leptocereus grantianus</i> (No common name)
E	<i>Lyonia truncata</i> var. <i>proctorii</i> (No common name)
E	<i>Mitracarpus maxwelliae</i> (No common name)
E	<i>Mitracarpus polycladus</i> (No common name)
E	<i>Myrcia paganii</i> (No common name)
E	Palo de rosa ( <i>Ottoschulzia rhodoxylon</i> )
E	<i>Peperomia</i> , Wheeler's ( <i>Peperomia wheeleri</i> )
E	Chupacallos ( <i>Pleodendron macranthum</i> )
E	<i>Polystichum calderonense</i> (No common name)
T	<i>Schoepfia arenaria</i> (No common name)
E	Erubia ( <i>Solanum drymophilum</i> )
T	Cobana negra ( <i>Stahlia monosperma</i> )
E	Palo de jazmin ( <i>Styrax portoricensis</i> )
E	<i>Tectaria estremerana</i> (No common name)
E	Palo colorado ( <i>Ternstroemia luquillensis</i> )
E	<i>Ternstroemia subsessilis</i> (No common name)
E	<i>Thelypteris inabonensis</i> (No common name)
E	<i>Thelypteris verecunda</i> (No common name)
E	<i>Thelypteris yaucoensis</i> (No common name)
E	Bariaco ( <i>Trichilia triacantha</i> )
E	<i>Vernonia proctorii</i> (No common name)
E	Prickly-ash, St. Thomas ( <i>Zanthoxylum thomasianum</i> )

**The following species are listed by the Department of Natural and Environmental Resources as Vulnerable or Threatened and Endangered in the Commonwealth of Puerto Rico:**

#### 1.07 DEFINITIONS

The terms, concepts and words, wherever they are used or reference in this Regulation will have the meaning that is defined here.

Species in Danger of Extinction (EPE) - Those species of vulnerable species and in danger of extinction whose population numbers are such that in opinion of the Secretary require special attention to assure their perpetuation in the physical space where they exist and which they are designated like Species in Danger or Critical Danger.

Species Vulnerable (VU) - Species that although are not in critical danger or danger, are facing a high risk of extinction in their wild state in the immediate future.

In Danger (EN) - Species that although are not in critical danger, face a high risk of extinction in the wild state in the near future.

In Critical Danger (PC) - Species that confront an extremely high risk of extinction in the immediate future.

Deficient in Data (DD) – There is a lack of scientific data on a particular species.

Uncommon (U) – Species is uncommon throughout its range.

Limited Range (LR) – Species distribution is naturally limited due to environmental requirements.

Wild fauna – Any resident animal species whose natural propagation does not depend on the fervor,(zeal) ,care or raising of its proprietary (owner) and found in wild state, or native or adapted in the ELA; or any migratory species that visits the ELA at any time of the year, as well as the exotic species defined accordingly in this Regulation. Arranging that it will be included in this definition, birds, mollusks, reptiles, arthropods, mammals, amphibians, fish and all the invertebrates including any parts, product, nest, egg, offspring or their dead body or parts from these.

Native - Species whose distribution and reproduction are not limited to the ELA and that are not exotic species.

Wildlife - Any organism whose propagation or natural survival does not depend on the fervor,(zeal) care of a human being and is in wild state; or native or adapted in Puerto Rico; or any migratory species that visits Puerto Rico at any time of the year, as well as the exotic species defined in this Law. Arranging that this definition include, but it is not limited to birds, aquatic or terrestrial reptiles, amphibians, all the invertebrates and plants, any part, product, nest, egg, offspring, flower, seed, leaf or its body or parts from these.

## NEW REGULATION FOR VULNERABLE SPECIES AND IN DANGER OF EXTINCTION

Appendix1. List of Vulnerable species in Danger of Extinction.

Regulation to manage Vulnerable and Endangered Species in the Commonwealth of Puerto Rico

## REGULATION TO GOVERN VULNERABLE SPECIES IN DANGER OF EXTINCTION IN THE ASSOCIATED FREE STATE OF PUERTO RICO.

### EXTRACTS....

#### 1.07 DEFINITIONS

The terms, concepts and words, wherever they are used or reference to in this Regulation will have the meanings that is defined here.

Species in Danger of Extinction (EPE) - Species of vulnerable species in danger of extinction whose population numbers are such that in opinion of the Secretary require special attention to ensure their perpetuation in the physical space where they exist and are designated species in Danger or Critical Danger.

Species Vulnerable (VU) - Species that although are not in critical danger or danger, or facing a high risk of extinction in their wild state in the immediate future.

In Danger (EN) - Species that although are not in critical danger, face a high risk of extinction in the wild state in the near future.

In Critical Danger (PC) - Species that are in an extremely high risk of extinction in the immediate future.

Deficient in Data (DD) – There is a lack of scientific data on a particular species.

Uncommon (U) – Species is uncommon throughout its range.

Limited Range (LR) – Species distribution is naturally limited due to environmental requirements.

Wild fauna – Any resident animal species whose natural propagation does not depend on the fervor (zeal) ,care or raising of its proprietary (owner) and found in wild state, or native or adapted in the ELA; or any migratory species that visits the ELA at any time of the year, as well as the exotic species defined accordingly in this Regulation. Arranging that it will be included in this definition, birds, mollusks, reptiles, arthropods, mammals, amphibians, fish and all the invertebrates including any parts, product, nest, egg, offspring or their dead body or parts from these.

Native - Species whose distribution and reproduction are not limited the ELA and that are not exotic species.

Wildlife - Any organism whose propagation or natural survival does not depend on the fervor(zeal) care of a human being and is in wild state; or native or adapted in Puerto Rico; or any migratory species that visits Puerto Rico at any time of the year, as well as the exotic species defined in this Law. Arranging that this definition include, but it is not limited to birds, aquatic or terrestrial reptiles, amphibians, all the invertebrates and plants, any part, product, nest, egg, offspring, flower, seed, leaf or its body or parts from these.

## NEW REGULATION FOR VULNERABLE SPECIES AND IN DANGER OF EXTINCTION

### Appendix 1. List of Vulnerable species in Danger of Extinction.

U	<i>Megaptera novaengliae</i> (Humpback whale)
EN	<i>Trichechus manatus</i> (West Indian Manatee)
DD	<i>Monophyllus redmani</i> (Greater antillean long tongued bat)
VU	<i>Stenoderma rufum</i> (Red fruit bat)
VU	<i>Erophylla sezekorni</i> (Brown flower bat)
DD	<i>Brachyphylla cavernarum</i> (Cave bat)
DD	<i>Noctilio leporinus</i> (No Common Name)
LR	<i>Tadarida brasiliensis</i> (Brazilian free-tailed bat)
DD	<i>Tachybaptus dominicus</i> (Least Grebe)
EN	<i>Pelecanus occidentalis</i> (Brown pelican)
EN	<i>Nomonix dominica</i> (Masked duck)
VU	<i>Oxyura jamaicensis</i> (Ruddy duck)
PC	<i>Dendrocygna arborea</i> (West Indian Whistling Duck)
VU	<i>Anas bahamensis</i> (White Cheeked Pintail)
CR	<i>Accipiter striatus venator</i> (Shinned Hawk)
CR	<i>Buteo platypterus brunescens</i> (Broad Winged Hawk)
DD	<i>Porzana flaviventer</i> (Yellow-breasted crake)
VU	<i>Fulica caribaea</i> (Caribbean coot)
CR	<i>Charadrius alexandrinus</i> (Snowy plover)
CR	<i>Charadrius melodus</i> (Piping plover)
DD	<i>Sterna antillarum</i> (Least tern)
VU	<i>Sterna dougalli</i> (Roseate tern)
CR	<i>Falco peregrinus tundrius</i> (Peregrine falcon)
EN	<i>Columba inornata wetmorei</i> (Plain pigeon)
DD	<i>Columba leucocephala</i> (White-crowned pigeon)



DD	<i>Geotrygon chrysia</i> (Key west quail-dove)
DD	<i>Geotrygon mystacea</i> (Bridled quail dove)
CR	<i>Amazona vittata vittata</i> (Puerto Rican parrot)
EN	<i>Agelaius xanthomus</i> (Yellow-shouldered blackbird)
DD	<i>Icterus dominicensis</i> (Black cowled oriole)
DD	<i>Ammodramus savannarum</i> (Grasshoper sparrow)
VU	<i>Dendroica angelae</i> (Elfin woods warbler)
LR	<i>Vireo latimeri</i> (Puerto Rican Vireo/ Latimer's Vireo)
DD	<i>Carduelis cucullata</i> (Red Siskin)
EN	<i>Caprimulgus noctiterus</i> (Puerto Rican Nightjar/Puerto Rican Whip Poor Will)
VU	<i>Epicrates inornatus</i> (Puerto Rican Boa)
CR	<i>Epicrates monensis granti</i> (Boa Pinta)
EN	<i>Epicrates monensis monensis</i> (Mona's Boa)
DD	<i>Typhlops monensis</i> (None)
DD	<i>Typhlops granti</i> (None)
DD	<i>Sphaerodactylus levinsi</i> (Desecheo's gecko)
DD	<i>Sphaerodactylus gaigae</i> (Pandura's gecko)
CR	<i>Sphaerodactylus micropithecus</i> (Monito's gecko)
VU	<i>Mabuya mabouya sloanei</i> (Slipperyback skink)
VU	<i>Anolis poncensis</i> (None)
EN	<i>Anolis cooki</i> (None)
CR	<i>Anolis roosevelti</i> (None)
EN	<i>Cyclura cornuta stejnegeri</i> (Mona Island Iguana)
EN	<i>Chelonia mydas</i> (Green Sea Turtle)
EN	<i>Eretmochelys imbricata</i> (Hawksbill Turtle)
EN	<i>Dermochelys coriacea</i> (Leather back turtle)
DD	<i>Trachemys stejnegeri</i> (Puerto Rican Slyder)
VU	<i>Eleutherodactylus cooki</i> (Cave frog/ Rock frog)
CR	<i>Eleutherodactylus jasperii</i> (Golden Coqui Frog)
CR	<i>Eleutherodactylus eneidae</i> (Mottled Coqui)
CR	<i>Eleutherodactylus karlschmidti</i> (Webbed footed Coqui/ Tree hole coqui)
DD	<i>Eleutherodactylus hedricki</i> (Hendrick's Coqui)
VU	<i>Eleutherodactylus locustus</i> (Locust Coqui/ Warty Coqui)
VU	<i>Eleutherodactylus richmondi</i> (Richmond's Coqui/ Ground Coqui)
VU	<i>Eleutherodactylus portoricensis</i> (Puertorican Mountain Coqui/ Forest Coqui)
CR/EN	<i>Peltophryne lemur</i> (Puerto Rican Crested Toad)
EN	<i>Epinephelus striatus</i> (Nassau grouper)
CR	<i>Epinephelus itajitara</i> (Jewfish)
CR	<i>Joturus pichardi</i> (Hognose mullet)
VU	<i>Hippocampus spp.</i> (Sea horses)
CR	<i>Atlantea tulita</i> (None)
LR	<i>Uca major</i> (None)
DD	<i>Uca thayeri</i> (None)
DD	<i>Uca vocator</i> (None)
LR	<i>Goniopsis cruentata</i> (None)
DD	<i>Aratus pisonii</i> (None)
LR	<i>Macrobrachium carcinus</i> (None)
DD	<i>Macrobrachium faustinum</i> (None)
LR	<i>Macrobrachium crenulatum</i> (None)

DD	<i>Macrobrachium acanthurus</i> (None)
DD	<i>Macrobrachium heterochirus</i> (None)
CR	<i>Typhlatya monae</i> (None)
LR	<i>Epilobocera suinuatifrons</i> (None)
LR	<i>Gecarcinus ruricola</i> (None)
DD	<i>Gecarcinus lateralis</i> (None)
LR	<i>Cardisoma guanhumi</i> (None)
LR	<i>Ucides cordatus</i> (None)
VU	<i>Panulirus laevicauda</i> (None)
CR	<i>Alloweckellia gurnee</i> (None)
CR	<i>Ilex cookii</i> (Cook's Holly)
EN	<i>Ilex sintenisii</i> (None)
EN	<i>Calyptronoma rivalis</i> (Puerto Rican Manac)
CR	<i>Vernonia proctorii</i> (None)
CR	<i>Crescentia portoricensis</i> (None)
EN	<i>Cordia bellonis</i> (Puerto Rico Manjack)
EN	<i>Buxus vahlii</i> (Vahl's Boxwood)
VU	<i>Harrisia portoricensis</i> (Higo Chumbo)
CR	<i>Leptocereus grantianus</i> (None)
CR	<i>Pleodendron macranthum</i> (None)
EN	<i>Cyathea dryopteroides</i> (None)
CR	<i>Lyonia truncata</i> var. <i>Proctorii</i> (None)
EN	<i>Chamaecrista glandulosa</i> variedad <i>mirabilis</i> (Puerto Rico Senna)
VU	<i>Stahlia monosperma</i> (None)
CR	<i>Banara vanderbiltii</i> (None)
VU	<i>Gesneria pauciflora</i> (None)
CR	<i>Ottoschulzia rhodoxylon</i> (None)
CR	<i>Juglans jamaicensis</i> (West Indian Walnut)
CR	<i>Trichilia triacantha</i> (None)
CR	<i>Calypttranthes thomasiana</i> (Thoma's Lidflower)
EN	<i>Eugenia haematocarpa</i> (None)
CR	<i>Eugenia woodburyana</i> (None)
CR	<i>Myrcia paganii</i> (None)
EN	<i>Schoepfia arenaria</i> (Arana)
CR	<i>Cranichis ricartii</i> (Orquidea)
CR	<i>Lepanthes eltoroensis</i> (None)
EN	<i>Peperomia wheeleri</i> (None)
EN	<i>Aristida chaseae</i> (None)
CR	<i>Aristida portoricensis</i> (None)
CR	<i>Adiantum vivesii</i> (None)
CR	<i>Elaphoglossum serpens</i> (CR)
CR	<i>Polystichum calderonense</i> (None)
CR	<i>Tectaria estremarana</i> (None)
CR	<i>Thelypteris inabonensis</i> (None)
CR	<i>Thelypteris verecunda</i> (None)
CR	<i>Thelypteris yaucoensis</i> (None)
CR	<i>Aurodendron pauciflorum</i> (None)
EN	<i>Mitracarpus maxwelliae</i> (None)
EN	<i>Mitracarpus polycladus</i> (None)

EN	<i>Zanthoxylum thomsonianum</i> (St. Thomas prickly-ash)
CR	<i>Styrax portoricensis</i> (None)
EN	<i>Goetzea elegans</i> (None)
EN	<i>Solanum drymophilum</i> (None)
CR	<i>Ternstroemia luquillensis</i> (None)
CR	<i>Ternstroemia subsessilis</i> (None)
CR	<i>Daphnopsis helleriana</i> (None)
CR	<i>Callicarpa ampla</i> (None)
CR	<i>Cornutia obovata</i> (None)

## Appendix 2. Designated Natural Essential Critical Habitat

### 1. *Eleutherodactylus jasper* (Golden Coquí)

The following places in the Municipality of Cayey are declared Natural Critical habitats.

a. Wasp Hill: Elevation area over 700 meters in the South and Southeastern sides of the mountain: from the North joint of Road 715 and a dirt road without numbering towards the south and the southwest throughout Road 715 to the South junction between Road 715 and the same dirt road without numbering, towards the north and the northeast throughout the dirt road right under the Southeastern slope of Wasp Hill and merges with Road 715.

b. Cat Mountain: All the summit elevations on the 700 meters: from the junction of Road 715 and the shoreline 700 meters towards the west throughout Highway 715 until merge Road 715 and a way without numbering, towards the north and the northeast throughout that way crossing the shoreline 700 meters, and from there towards the east throughout the shoreline 700 meters crossing Road 715.

c. Cayey Mountain range: Elevation areas of 700 meters: from the junction of Road 738 and Road 15 towards the Southeastern throughout 15 to a point 500 meters to the south of the 684.5 reference point from there straight to the northeast to a point on Road 7741 and Road 738, from there towards the north, northwest throughout Road 7741 to its junction with Road 738, and from there towards the northwest throughout Road 738 to its junction with Road 15.

### 2. *Anolis roosevelti* (Roosevelt's Anole)

Snake Island area indicated in the map included here.

### 3. *Cyclura stegnetjeri*

Mona Island, except structures and houses.

### 4. *Epicrates monensis*

Mona Island in its totality, except by structures and houses.

### 5. *Agelaius xanthomus*

Adopted as critical habitat for species that are designated by the Federal Fish and Wildlife Service. Includes Mona Island, Cabo Rojo (Red Horn), Lajas and Guanica municipalities, in the southwest of Puerto Rico; a circular area with a radio of one mile in the San German Town; Roosevelt Road Naval base to the Southeastern of the Ceiba Municipality. (Ref (50CFR 17,95 (b) for more detailed information)

## 2.2.4 Humaneness of Control Methods

The issue of humaneness, as it relates to the killing or capturing of wildlife is an important, but very complex concept that can be interpreted in a variety of ways. Humaneness is a person's perception of harm or pain inflicted on an animal, and people may perceive the humaneness of an action differently. Animal welfare organizations are concerned that some methods used to manage wildlife damage expose animals to unnecessary pain and suffering. Research suggests that with some methods, such as restraint in leghold traps, changes in the blood chemistry of trapped animals indicate "stress." Blood measurements indicated similar changes in foxes that had been chased by dogs for about five minutes as those restrained in traps (USDA 1997). However, such research has not yet progressed to the development of objective, quantitative measurements of pain or stress for use in evaluating humaneness.

The decision making process involves tradeoffs between managing damage and the aspect of humaneness. The challenge in coping with this issue is how to achieve the least amount of animal suffering with the constraints imposed by current technology, yet provide sufficient damage management to resolve problems.

WS has improved the selectivity of management devices through research and development such as pan tension devices for traps and breakaway snares. Research is continuing to bring new findings and products into practical use. Until such time as new findings and products are found to be practical, a certain amount of alleged animal suffering will occur if management objectives are to be met in those situations where nonlethal control methods are not practical.

WS personnel in Puerto Rico are experienced and professional in their use of management methods. Consequently, control methods are implemented in the most humane manner possible under the constraints of current technology. Mitigation measures and SOPs used to maximize humaneness are listed in Chapter 3.

### **2.2.5 Effects of Control Methods on Human Health and Safety**

A common concern is whether the proposed action or any of the alternatives pose an increased threat to human health and safety. Specifically, there is concern that control methods potentially used in feral and free-ranging patas and rhesus monkey removal (i.e., shooting, traps, snares) may be hazardous to humans.

Firearm use in wildlife damage control can be a publicly sensitive issue. Safety issues related to the misuse of firearms and the potential human hazards associated with firearms use are concerns both to the public and WS. To ensure safe use and awareness, WS employees who use firearms to conduct official duties are required to attend an approved firearms safety and use training program within 3 months of their appointment and a refresher course every 2 years thereafter (WS Directive 2.615). WS employees, who use firearms as a condition of employment, are required to sign a form certifying that they meet the criteria as stated in the *Lautenberg Amendment* which prohibits firearm possession by anyone who has been convicted of a misdemeanor crime of domestic violence. Additionally, WS runs thorough background checks on all new employees entering the agency and the WS Program conducts annual firearms training for its personnel.

### **2.2.6 Effects on the Aesthetic Values of Targeted Species and Protected T&E Species**

The human attraction to animals has been well documented throughout history and started when humans began domesticating animals. The American and International public share a similar

bond with animals and/or wildlife in general, and in modern societies a large percentage of households have indoor or outdoor pets. However, some people may consider individual wild animals and birds as "pets" or exhibit affection toward these animals, especially people who enjoy coming in contact with wildlife. Therefore, the public reaction is variable and mixed to wildlife damage management because there are numerous philosophical, aesthetic, and personal attitudes, values, and opinions about the best ways to manage conflicts/problems between humans and wildlife.

There is some concern that the proposed action or the alternatives would result in the loss of aesthetic benefits to the public, resource owners, or neighboring residents. Wildlife generally is regarded as providing economic, recreational, and aesthetic benefits (Decker and Goff 1987), and the mere knowledge that wildlife exists is a positive benefit to many people. Aesthetics is the philosophy dealing with the nature of beauty, or the appreciation of beauty. Therefore, aesthetics is truly subjective in nature, dependent on what an observer regards as beautiful.

Wildlife populations provide a wide range of social and economic benefits (Decker and Goff 1987). These include direct benefits related to consumptive and non-consumptive use (e.g., wildlife-related recreation, observation, harvest, sale, etc.), indirect benefits derived from vicarious wildlife related experiences (e.g., reading, television viewing, etc.), and the personal enjoyment of knowing wildlife exists and contributes to the stability of natural ecosystems [e.g., ecological, existence, bequest values (Bishop 1987)]. Direct benefits are derived from a user's personal relationship to animals and may take the form of direct consumptive use (using parts of or the entire animal) or non-consumptive use [viewing the animal in nature or in a zoo, photography (Decker and Goff 1987)]. Indirect benefits or indirect exercised values arise without the user being in direct contact with the animal and come from experiences such as looking at photographs and films of wildlife, reading about wildlife, or benefiting from activities or contributions of animals such as their use in research (Decker and Goff 1987). Indirect benefits come in two forms: bequest and pure existence (Decker and Goff 1987). Bequest is providing for future generations and pure existence is merely knowledge that the animals exist (Decker and Goff 1987).

Some people have an idealistic view of wildlife and believe that all wildlife should be captured and relocated to another area to alleviate damage or threats to protected resources. Some people directly affected by the problems caused by wildlife strongly support removal. Individuals not directly affected by the harm or damage may be supportive, neutral, or totally opposed to any removal of wildlife from specific locations or sites. Some people totally opposed to wildlife damage management want WS to teach tolerance for damage and threats caused by wildlife, and that wildlife should never be killed. Some of the people who oppose removal of wildlife do so because of human-affectionate bonds with individual wildlife. These human-affectionate bonds are similar to attitudes of a pet owner and result in aesthetic enjoyment.

WS only conducts feral and free-ranging patas and rhesus monkey damage management at the request of the affected property owner or resource manager. If WS received requests from an individual or official for feral and free-ranging patas or rhesus monkey damage management, WS would address the issues/concerns and consideration would be given as to the extent of WS involvement. Management actions would be carried out in a caring, humane, and professional manner.

## **2.3 ISSUES CONSIDERED BUT NOT IN DETAIL WITH RATIONALE**

### **2.3.1 Legal Constraints on Implementation of Control.**

WS is required to follow and adhere to all federal and state regulations. The methods proposed for use in feral and free-ranging patas and rhesus monkey damage management are all permitted by federal and state laws, or the appropriate exemptions/permits will be obtained.

### **2.3.2 Cost Effectiveness of Control Methods.**

The Council on Environmental Quality (CEQ) does not require a formal, monetized cost benefit analysis to comply with NEPA. Consideration of this issue is not essential to making a reasoned choice among the alternative being considered. However, the methods determined to be most effective in controlling feral and free-ranging patas and rhesus monkey damage and proven to be most cost effective will receive the greatest application. Additionally, control operations may be constrained by cooperator monies and/or objectives and needs.

## CHAPTER 3: ALTERNATIVES

### INTRODUCTION

Alternatives were developed for consideration using the ADC Decision Model as described in Chapter 2 (pages 20-35), Appendix J (Methods of Control), Appendix N (Examples of ADC Decision Model), and Appendix P (Risk Assessment of Wildlife Damage Control Methods Used by the USDA, Wildlife Services Program) of the *Animal Damage Control Program Final Environmental Impact Statement* (USDA 1997).

Chapter 3 contains a discussion of the project alternatives, including those that will receive detailed environmental impacts analysis in Chapter 4 (Environmental Consequences), and alternatives considered but not analyzed in detail, with rationale, and mitigation measures and SOPs for wildlife damage management techniques (WDM).

### ALTERNATIVES ANALYZED IN DETAIL

**Alternative 1 - No Action** - This alternative precludes any and all WDM activities by WS to protect human health and safety, protect agricultural resources, alleviate nuisance issues, and protect native wildlife species from impacts associated with feral and free-ranging patas and rhesus monkey populations in the Commonwealth of Puerto Rico.

**Alternative 2 - Nonlethal Control Before Lethal Control** - This alternative would not allow the use of lethal control by WS until all available nonlethal methods had been applied and determined to be inadequate in each damage situation.

**Alternative 3 - Nonlethal Control Only** - This alternative would involve the use of nonlethal management techniques only by WS.

**Alternative 4 - Lethal Control Only** - This alternative would involve the use of lethal management techniques only by WS.

**Alternative 5 - Integrated Wildlife Damage Management (the Proposed Action)** - This alternative would incorporate an integrated approach to wildlife damage management using components of the wildlife damage management techniques and methods addressed in Alternatives 3 and 4, as deemed appropriate by WS and other participating entities.

### Integrated Wildlife Damage Management (IWDM)

The most effective approach to resolving wildlife damage is to integrate the use of several methods simultaneously or sequentially. The philosophy behind IWDM is to implement the best combination of effective management methods in the most cost-effective<sup>1</sup> manner while minimizing the potentially harmful effects on humans, target and non-target species, and the environment. IWDM may incorporate cultural practices (e.g., animal husbandry), habitat modification (e.g., exclusion), animal behavior modification (e.g., scaring), removal of individual offending animals, local population reduction, or any combination of these, depending on the circumstances of the specific damage problem.

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<sup>1</sup> The cost of management may sometimes be secondary because of overriding environmental, legal, human health and safety, animal welfare, or other concerns.

## **The IWDM Strategies Employed by WS**

**Technical Assistance Recommendations.** "Technical assistance" as used herein is information, demonstrations, and advice on available and appropriate wildlife damage management methods and approaches. The implementation of damage management actions is the responsibility of the requester. In some cases, WS provides supplies or materials that are of limited availability for use by non-WS entities. Technical assistance may be provided through a personal or telephone consultation, or during an on-site visit with the requester. Generally, several management strategies are described to the requester for short and long-term solutions to damage problems; these strategies are based on the level of risk, need, and the practicality of their application. In some instances, wildlife-related information provided to the requestor by WS results in tolerance/acceptance of the situation. In other instances, management options are discussed and recommended.

Under APHIS NEPA implementing regulations and specific guidance for the WS program, WS technical assistance is categorically excluded from the need to prepare an EA or EIS. However, it is discussed in this EA because it is an important component of the IWDM approach to resolving wildlife damage problems.

**Direct Damage Management Assistance (Direct Control).** Direct damage management assistance includes damage management activities that are directly conducted or supervised by WS personnel. Direct damage management assistance may be initiated when the problem cannot effectively be resolved through technical assistance alone and when *Agreements for Control* or other comparable instruments are provided for direct damage management by WS. The initial investigation defines the nature, history, and extent of the problem; species responsible for the damage; and methods available to resolve the problem. The professional skills of WS personnel are often required to effectively resolve problems, especially if restricted use chemicals are necessary or if the problems are complex.

**Educational Efforts.** Education is an important element of WS program activities because wildlife damage management is about finding balance and coexistence between the needs of people and needs of wildlife. This is extremely challenging as nature has no balance, but rather, is in continual flux. In addition to the routine dissemination of recommendations and information to individuals or organizations sustaining damage, lectures, courses, and demonstrations are provided to producers, homeowners, state and county agents, colleges and universities, and other interested groups. WS frequently cooperates with other agencies in education and public information efforts. Additionally, technical papers are presented at professional meetings and conferences so that WS personnel, other wildlife professionals, and the public are periodically updated on recent developments in damage management technology, programs, laws and regulations, and agency policies.

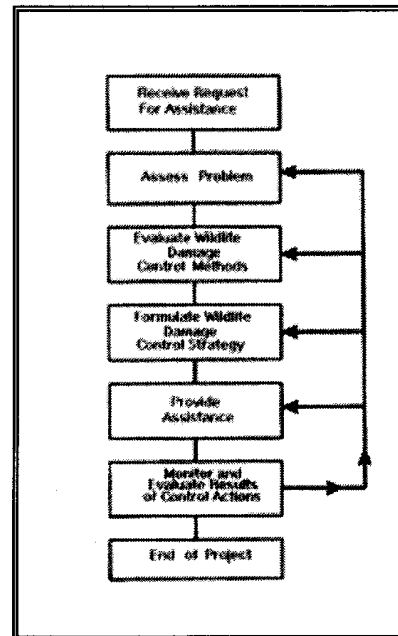
**Research and Development.** The National Wildlife Research Center (NWRC) functions as the research arm of WS by providing scientific information and development of methods for wildlife damage management that are effective and environmentally responsible. NWRC scientists work closely with wildlife managers, researchers, field specialists and others to develop and evaluate wildlife damage management techniques. NWRC scientists have authored hundreds of scientific publications and reports, and are respected world-wide for their expertise in wildlife damage management.

**WS Decision Making.** WS personnel use a thought process for evaluating and responding to damage complaints which is depicted by the WS Decision Model and described by Slate et al. in 1992 (Figure 3-1). WS personnel are frequently contacted after requesters have tried or considered non-lethal methods and found them to be impractical, too costly, or inadequate for effectively reducing damage. WS



personnel assess the problem then evaluate the appropriateness and availability (legal and administrative) of strategies and methods based on biological, economic and social considerations. Following this evaluation, methods deemed to be practical for the situation are incorporated into a management strategy. After this strategy has been implemented, monitoring is conducted and evaluation continues to assess the effectiveness of the strategy. If the strategy is effective, the need for further management is ended. In terms of the WS Decision Model (Slate et al. 1992), most damage management efforts consist of continuous feedback between receiving the request and monitoring the results of the damage management strategy. The Decision Model is not a written documented process, but a mental problem-solving process common to most, if not all, professions.

**Figure 3-1**  
WS Decision Model



### 3.1 DESCRIPTION OF THE ALTERNATIVES

#### 3.1.1 Alternative 1 - No Action

This alternative precludes any and all WDM activities by WS to protect human health and safety, protect agricultural resources, alleviate nuisance issues, and protect native wildlife species from impacts of feral and free-ranging patas and rhesus monkeys in the Commonwealth of Puerto Rico. WS would not provide direct operational or technical assistance and requesters of WS's assistance would have to conduct their own WDM without WS input. A city and/or natural resource manager or any other public or private entity directed at preventing or reducing the impacts of feral and free-ranging patas and rhesus monkeys could conduct WDM practices in the absence of WS involvement.

#### 3.1.2 Alternative 2 - Nonlethal Control Before Lethal Control

This Alternative would require that all methods or techniques described in 3.1.3 be applied and determined to be inadequate in each damage situation prior to the implementation of any of the

methods or techniques described in 3.1.4. This would be the case regardless of the severity or intensity of hazards and concerns associated with feral and free-ranging patas and rhesus monkey populations on the resources proposed for protection in this EA.

### **3.1.3 Alternative 3 - Nonlethal Control Only**

Exclusion devices, frightening devices, trap-sterilize-vaccinate-release, and relocation or sale of feral and free-ranging patas and rhesus monkeys are the only nonlethal control methods currently available for use to protect affected resources in Puerto Rico.

Trap-sterilize-release-relocation, sale of feral and free-ranging patas and rhesus monkeys, and trap and relocate back into the wild alternatives would not be carried out by WS for the reasons described in Sections 3.2.1., 3.2.2, and 3.2.3. Nonlethal frightening devices have been determined to be unacceptable for use in any of the Alternatives. Frightening devices involving the use of electronic guards, pyrotechnics, propane cannons, and lights could potentially be used for temporary relief of feral and free-ranging patas and rhesus monkeys; however, feral and free-ranging patas and rhesus monkeys often become acclimated to such methods fairly rapidly and the use of these devices have the potential of adversely affecting humans and wildlife species needing protection. A detailed description of why frightening devices are not being considered in detail in this EA is found in Section 3.2.4.

WS involvement in management strategies involving nonlethal methods would be limited.

#### **Exclusion**

Exclusion devices are applicable for use only on small areas (< 5 hectares). They are neither feasible nor effective for protecting humans, agriculture, or wildlife species from feral and free-ranging patas and rhesus monkeys across large areas. This alternative could be used to deter patas and rhesus monkeys from using small agricultural areas for short time periods. Exclusion could be achieved using electrified fencing to prevent use by monkeys.

If exclusion by electric fencing is employed by WS, it would only be used temporarily to prevent or reduce impacts to agriculture, human health and safety, and protection of native wildlife, including T & E species. Exclusion would not be used as a long term solution.

### **3.1.4 Alternative 4 - Lethal Control Only**

This alternative would allow the lethal removal of feral and free-ranging patas and rhesus monkeys that pose a health and safety threat to humans, agriculture damage, creating a nuisance, and those posing a predation threats to native wildlife. Populations of feral and free-ranging patas and rhesus monkeys would be reduced or possibly eliminated throughout Puerto Rico. Lethal control methods would be applied in all areas of control operations. Feral and free-ranging patas and rhesus monkeys that are live captured in traps or snares would be subsequently euthanized on site in a humane manner utilizing AMVA approved methods (Beaver et al. 2001) and WS SOP's. Euthanization would occur by either injection with a WS approved drug or by shooting. Deceased animals would be buried or taken to a landfill, in accordance with WS policy and Commonwealth of Puerto Rico Regulations. Unharmred and uninjured nontarget animals that could be safely handled, would be released on site.

Lethal methods of wildlife control are often very effective when used properly. Specific problem animals can be targeted and removed without negatively affecting the local population of a species (Bailey 1984). All control measures would be implemented in accordance with applicable Federal and Commonwealth laws, and WS policy. Weather and environmental conditions permitting, all field equipment would be checked at least once each day. If daily checking is not possible, all control equipment would be removed from the site. Population reduction of feral and free-ranging patas and rhesus monkeys would be implemented by WS personnel with assistance from the participating city and/or natural resource managers or landowners. Target animals would be lethally removed using the methods and techniques listed below.

a. Ground Shooting - This method would be used to selectively remove feral and free-ranging monkeys. Most shooting would be done in conjunction with night spotlighting and night shooting. Opportunistic shooting of target animals would occur in areas away from public use areas or during times when the public would not be present. This alternative would only be used in areas and at times which are deemed safe.

b. Leghold Traps - This method would be used to capture and restrain target animals. Leghold traps, of the appropriate size and type, would be utilized to capture specific target animals. Leghold traps are a versatile and widely used control method. Placement of these traps is contingent upon the habits of the respective target species, habitat conditions, and presence of nontarget animals.

Opposition to the use of leghold traps has increased in recent years due to public concern that the leghold trap inflicts unacceptable injuries to trapped animals. Research on the No. 3 Victor Soft Catch leghold trap has demonstrated that coyotes can be successfully captured while producing only minor leg injuries (Phillips et al. 1996). Recent research comparing leg injuries associated with standard and modified Soft Catch leghold traps indicates that the addition of a "taos lightning" spring kit can further reduce injuries to captured animals and increase capture efficiency (Gruver et al. 1996). Soft Catch leghold traps modified with "taos lightening" springs kits may be used in some situations. Additionally, padded-jawed leghold traps may also be used to capture and restrain target species, however, WS will not limit trapping efforts to these devices.

c. Walk-in Cage or Corral Traps - These traps would be set in areas where leghold traps could not be used, or when it was deemed more efficient to use them. Placement of walk-in cage traps is contingent upon the habits of the respective target species, habitat conditions, and presence of nontarget animals. Traps placed in travel lanes of the target animal, using location rather than attractants, are known as "blind sets". More frequently, traps are placed as "baited" or "scented" sets, using an attractant consisting of fruit or other food attractants to attract the animal into the trap.

d. Snares - Snares are capture devices comprised of a cable loop and a locking device. Most snares are equipped with a swivel to minimize cable twisting and breakage. Snares can be set as either lethal or live-capture devices. Neck snares are designed to tighten around an animal's neck as it passes through the device. Leg snares are live-capture devices meant to restrain the animal by tightening around the leg. Snares would be used as live-capture devices in narrow passageways and along well used game trails. Lethal snares would be considered in rare occasions; however, live-capture snares may be used. Neck snares used in association with this project would incorporate break away locks.

- e. Drop-nets – Nylon or cloth nets that are suspended above an area actively used by an animal or group of animals and then released when the animals are underneath the net. Method is generally used to catch entire group of animals.
- f. Cannon Nets – Nylon or cloth nets that are launched over a group of animals via the use of weights and explosive charges. Method is generally used to catch entire group of animals.
- g. Drugs - Drugs such as anesthetics (Ketamine, Telazol), analgesics (Xylazine), and barbiturates (Sodium Pentobarbital) are used to capture, sedate, or euthanize animals involved in wildlife damage or disease situations.

**Ketamine** (Ketamine HCl) is a dissociative anesthetic that is used to capture wildlife, primarily mammals, birds, and reptiles. It is used to eliminate pain, calm fear, and allay anxiety. Ketamine is possibly the most versatile drug for chemical capture, and it has a wide safety margin (Fowler and Miller 1999). When used alone, this drug may produce muscle tension, resulting in shaking, staring, increased body heat, and, on occasion, seizures. Usually, ketamine is combined with other drugs such as xylazine. The combination of such drugs is used to control an animal, maximize the reduction of stress and pain, and increase human and animal safety. A Federal (Drug Enforcement Administration (DEA)) license is required to possess ketamine.

**Xylazine** is a sedative (analgesic) that calms nervousness, irritability, and excitement, usually by depressing the central nervous system. Xylazine is commonly used with ketamine to produce a relaxed anesthesia. It can also be used alone to facilitate physical restraint. Because xylazine is not an anesthetic, sedated animals are usually responsive to stimuli. Therefore, personnel should be even more attentive to minimizing sight, sound, and touch. When using ketamine/xylazine combinations, xylazine will usually overcome the tension produced by ketamine, resulting in a relaxed, anesthetized animal (Fowler and Miller 1999). This reduces heat production from muscle tension, but can lead to lower body temperatures when working in cold conditions. No Federal license is required for Xylazine.

**Sodium Pentobarbital** is a barbiturate that rapidly depresses the central nervous system to the point of respiratory arrest. There are DEA restrictions on who can possess and administer this Schedule II drug. Some states may have additional requirements for personnel training and particular sodium pentobarbital products available for use in wildlife. Certified WS personnel are authorized to use sodium pentobarbital and dilutions for euthanasia in accordance with DEA regulations.

**Potassium Chloride** used in conjunction with prior general anesthesia is used as a euthanasia agent for animals, and is considered acceptable and humane by the AVMA (Beaver et al. 2001). Potassium chloride is not a Federally-controlled substance, and animals that have been euthanized with this chemical are not toxic to predators or scavengers. Anesthetized animals injected with potassium chloride experience cardiac arrest followed by death.

### **3.1.5 Alternative 5 - Integrated Wildlife Damage Management (Proposed Action)**

This alternative, the proposed action, would incorporate an integrated damage management program utilizing techniques and methods described in Alternatives 3 and 4 to reduce the threat to human health and safety, agricultural damage, nuisance issues, and native wildlife from feral and free-ranging patas and rhesus monkeys. Populations of feral and free-ranging patas and rhesus monkeys would be reduced or possibly eliminated throughout Puerto Rico. This strategy would incorporate nonlethal and lethal control measures. An IWDM strategy would be recommended and used, encompassing the use of practical and effective methods of preventing or reducing damage while minimizing harmful effects of damage management measures on humans, target and non-target species, and the environment. Under this action, WS could provide technical assistance and direct operational damage management, including non-lethal and lethal management methods by applying the WS Decision Model (Slate et al. 1992).

Management strategies involving exclusionary devices may be implemented by urban and natural resource management or WS personnel in accordance with WS recommendations. Population reduction of free-ranging patas and rhesus monkeys to reduce immediate health and safety concerns, agriculture damage, nuisance issues, and potential predation to native wildlife would be implemented by WS personnel with assistance from urban and natural resource managers, as appropriate.

## **3.2 ALTERNATIVES CONSIDERED BUT NOT ANALYZED IN DETAIL WITH RATIONALE**

### **3.2.1 Trap, Sterilize, and Release (TSR) Alternative**

This topic has undergone considerable debate in animal welfare and scientific communities for a number of years. Two main questions or viewpoints dominate this debate: 1) Does trap-sterilize-release work in controlling feral or free-ranging animal populations over the long run or even the short run? and 2) Does TSR programs address or alleviate problems (i.e., diseases, predation, agricultural damage, nuisance) created by feral or free-ranging animal populations?

Theoretically, trap, sterilize, and release would work if all animals of one sex or both were sterilized. However, in nature the probability of controlling an exotic or nonnative species in the wild with this technique is not currently reasonable, especially with the animals being self-sufficient and not relying on human handouts to survive. Additionally, it is common knowledge within the trapping community, that there are always individuals within a population that are trap shy. Capturing or removing trap shy individuals often requires implementing other methods.

As a result of the prevalent and indeterminate threat to human health and safety created by TSR programs (patas and rhesus monkeys colonies) and the continued threat to threatened and endangered wildlife and native wildlife in general, WS will not consider this issue further or be a participant of any TSR program in Puerto Rico.

### **3.2.2 Live Capture for Sale to Zoos, Nature Parks, Private Individuals, or Primate Medical Research Facilities Alternative**

Capturing wildlife, exotic species, or any animal for sale or for profit is not allowed in the WS Directives, and to provide animals for sale is neither ethical nor sound wildlife management. Additionally, more than 70% of free-ranging rhesus (72% of 57 monkeys) sampled in Puerto

Rico in 1997 were positive for *Cercopithecine herpesvirus 1* antibodies (Gonzalez-Martinez et al. 2002).

Several attempts have been made to control patas and rhesus numbers via live-capture in southwestern Puerto Rico. Between 1979 and 1985, Primate Reclamation's of Puerto Rico captured 128 rhesus and 35 patas monkeys. The Wildlife Control Society captured 40 rhesus and 4 patas monkeys (1988-1989). And the Caribbean Primate Research Center/University of Puerto Rico removed 14 patas monkeys during an unidentified time period. Over a 10-year period using live-capture techniques, the monkey problem still persists in Puerto Rico and has most likely expanded in scope (Gonzalez-Martinez 1995).

### **3.2.3 Trap and Relocate Back into the Wild Alternative**

This alternative would allow the live capture of feral and free-ranging patas and rhesus monkeys using walk-in traps, drop-nets, cannon nets, snares, and/or leghold traps. Captured animals would be tranquilized and translocated to other areas where they would be released back into the wild or free living state.

Relocation of wildlife is often viewed as inhumane and biologically unsound management, especially when the wildlife species being relocated is exotic, nonnative, nuisance, and considered a human health and safety threat. Consequently, WS will not relocate any feral and free-ranging patas and rhesus monkeys captured during control operations back into the wild. If certain segments of the public demand relocation, then it will be up to that group(s) to acquire the appropriate permits and/or homes for the monkeys.

### **3.2.4 Frightening Devices Alternative**

Frightening devices such as electronic guards, pyrotechnics, propane cannons, and lights can be used to temporarily alleviate some animals' activity. The effectiveness of these devices depends upon the individual animal's fear of, and subsequent aversion to the offensive stimuli. Once an animal habituates to these stimuli, it often resumes its normal activities and movements.

The continuous and prolonged utilization of artificial lighting along some locations could have negative impacts on certain wildlife species. One well documented problem has been with beach habitats and nesting sea turtles and shorebirds. The use of artificial lighting may deter female sea turtles (Witherington and Martin 1996) and shorebirds, discouraging them from nesting at historic nesting sites. In addition, newly hatched sea turtles are strongly attracted to light sources (Raymond 1984, Witherington 1995, Witherington 1991). This disorientation could lead to increased mortality due to predation, dehydration, and exhaustion. Lights could also inhibit the foraging behavior of other nocturnal species. Additionally, artificial lights will not alter long-term patas and rhesus monkeys behavior by disrupting movement or causing avoidance of illuminated sites in urban areas. Most feeding by patas and rhesus monkeys is diurnal.

The impact of noise resulting from the use of electronic guards, pyrotechnics, and propane exploders would not be allowed in an urban setting for extended periods of time. There is little evidence to suggest that such frightening techniques would cause patas and rhesus monkeys to avoid an area. Noise associated with the above devices, potentially could impact both the humans and native wildlife proposed for protection in this EA.

### **3.2.5 Biological Control Alternative**

Biological control is most commonly used to control select evasive plant and insect species. Very little effort has been devoted to the biological control of feral and free-ranging primates for two reasons: 1) there has not been any biological control agent developed that will work on feral and free-ranging monkey populations only and not potentially effect monkeys kept indoors or at research facilities and 2) it is not known how any potential biological control agents for monkeys would effect humans or other species (Dobson 1988).

### **3.2.6 Poisoning Alternative**

Historically, poisoning has been a common practice in controlling many nuisance wildlife populations. It was common for both target and non-target species to be negatively impacted by broad scale poisoning campaigns. The use of select toxicants have proven effective at removing select exotic or feral animals on some island situations in New Zealand (Eason, C. T., D. R. Morgan, and B. K. Clapperton 1992) and poisoning is still commonly used to control some nuisance species in the United States (i.e., rodents, starlings, etc.). However, due to concerns associated with poisoning, Wildlife Services will not incorporate poisoning into its integrated wildlife damage management program in Puerto Rico for controlling feral and free-ranging patas and rhesus monkeys.

## **3.3 MITIGATION AND SOP's FOR WILDLIFE DAMAGE MANAGEMENT TECHNIQUES**

### **3.3.1 Mitigation Measures**

Mitigation measures are any features of an action that serve to prevent, reduce, or compensate for impacts that otherwise might result from that action. The current WS Program, nationwide and in Puerto Rico, uses many such mitigation measures and these are discussed in detail in Chapter 5 of the FEIS (USDA 1997).

Some key mitigating measures pertinent to the proposed action and alternatives that are incorporated into WS's SOPs include the following.

- ♦ The WS Decision Model, which is designed to identify effective wildlife damage management strategies and their impacts, is consistently used.
- ♦ Nontarget animals captured in traps or snares are released unless it is determined by a WS Specialist that the animal will not survive and/or that the animal can not be released safely.
- ♦ Conspicuous, bilingual warning signs alerting people to the presence of traps and snares may be placed at major access points to areas where WS is conducting active patas and rhesus monkey management operations, if it has been determined that the presence of the signs would not impact the efficacy of the management program in an area.
- ♦ Reasonable and prudent alternatives and measures are established through consultation with the USFWS and implemented to avoid adverse impacts to T&E species.

### **3.3.2 Additional Mitigation Measures and SOPs for Wildlife Damage Management Techniques**

Some additional mitigating factors specific to the current program include the following:

- ♦ All WS Specialists who use restricted-use chemicals are trained and certified by WS personnel or others who are experts in the safe and effective use of these substances or are supervised by such qualified persons.
- ♦ Management actions are directed toward specific species or individual animals posing a threat to human health and safety, agricultural damage, nuisance, and predation on native wildlife species. Control actions would only be directed towards feral and free-ranging patas and rhesus monkeys in Puerto Rico.
- ♦ Weather and environmental conditions permitting, all field equipment would be checked at least once each day. If daily checking is not possible, all control equipment would be removed from the site.
- ♦ Although hazards to the public from control devices and activities are low according to a formal risk assessment (USDA 1997, Appendix P), hazards to the public and their pets are even further reduced by the fact that control activities are primarily conducted during low human activity periods and by trained wildlife damage management specialists.

### **3.4 ADDITIONAL MITIGATION MEASURES SPECIFIC TO THE ISSUES.**

The following is a summary of additional mitigation measures that are specific to the issues listed in Chapter 2 of this document.

#### **Effects on Target Species Populations**

- ♦ WS activities conducted to resolve issues involving feral and free-ranging patas and rhesus monkey with respect to human health and safety, agricultural damage, nuisance, and predation on native wildlife will be directed towards the eradication of both nonnative monkey species within specified areas of Puerto Rico.
- ♦ WS lethal take (kill) data are regularly monitored by WS biologists to evaluate method efficacy, humaneness, and evaluate new alternatives as they become available.

#### **Effects on Nontarget Species**

- ♦ WS activities conducted to resolve wildlife damage are directed towards individual problem animals, or local populations or groups.
- ♦ When conducting removal operations via shooting, WS will shoot only target species or animals and will not shoot an animal that can not be accurately identified.
- ♦ As appropriate, suppressed firearms will be used to minimize noise impacts.



- ♦ When conducting nighttime activities, potential impacts associated with spotlights would be minimized by the use of night vision equipment, infrared devices, or red filtered spotlights.
- ♦ Human presence at control sites would be kept to the minimal time needed to accomplish the management action.
- ♦ WS specialists use lures, trap placements (sets), and capture devices that are strategically placed at locations likely to capture a target animal and minimize the potential of nontarget animal captures.
- ♦ As appropriate, capture devices will be equipped in such a manner to reduce the potential of capture nontarget animals (pan-tension devices, break-away snares, snare stop-locks, etc.)
- ♦ Any nontarget animals captured in snares, cage traps, nets, or leghold traps will be released whenever it is possible and safe to do so.

### **Effects on Human Health and Safety**

- ♦ WS control operations will be conducted professionally and in the safest manner possible. Most trapping will be conducted away from areas of high human activity and when determined necessary, signs will be placed to warn the public of any potential hazards.
- ♦ WS feral and free-ranging patas and rhesus monkey management via shooting will be conducted professionally and in the safest manner possible. Shooting will be conducted during time periods when public activity and access to the control areas are restricted. WS personnel involved in shooting operations will be fully trained in the proper and safe application of this method.

### **Humaneness of Methods Used by WS**

- ♦ WS specialists will be well trained in the latest and most humane devices/methods for removing problem wildlife.
- ♦ WS personnel attempt to dispatch captured target animals, slated for lethal removal, as quickly and humanely as possible. In most field situations, a precise shot to the brain using a small caliber firearm is performed. This method causes rapid unconsciousness followed by the cessation of heart and respirator functions, resulting in a humane and rapid death. This method is in concert with the American Veterinary Medical Association's (AVMA) definition of euthanasia (Beaver et al. 2001).
- ♦ The WS's, National Wildlife Research Centers (NWRC) are continually conducting research, with the goal, to improve the selectivity and humaneness of wildlife damage management devices used by WS personnel in the field.

## **CHAPTER 4: ENVIRONMENTAL CONSEQUENCES**

### **INTRODUCTION**

Chapter 4 provides information needed for making informed decisions on the feral and free-ranging patas and rhesus monkey damage management objectives outlined in Chapter 1 and the issues and affected environment discussed in Chapter 2. This chapter analyzes the environmental consequences of each alternative in relation to the issues identified for detailed analysis. This chapter analyzes the environmental consequences of each alternative in comparison with the No Action Alternative to determine if the real or potential impacts would be greater, lesser, or the same. Therefore, the No Action Alternative serves as the baseline for the analysis and the comparison of expected impacts among the alternatives. The analysis also takes into consideration WS mandates, directives, and the procedures used in the WS decision process (USDA 1997).

The following resource values within the Commonwealth of Puerto Rico are not expected to be significantly impacted by any of the alternatives analyzed: soils, geology, minerals, water quality/quantity, flood plains, wetlands, critical habitats (areas listed in T&E species recovery plans), visual resources, air quality, prime and unique farmlands, aquatic resources, timber, and range. These resources will not be analyzed further.

**Cumulative Effects:** Cumulative effects are discussed in relationship to each of the alternatives analyzed, with emphasis on potential cumulative effects from methods employed, and including summary analyses of potential cumulative impacts to target and non-target species, including T&E species.

**Irreversible and Irretrievable Commitments of Resources:** Other than minor uses of fuels for motor vehicles and other materials, there are no irreversible or irretrievable commitments of resources.

**Effects on sites or resources protected under the National Historic Preservation Act:** WS WDM actions are not undertakings that could adversely affect historic resources (See Section 1.6.2).

#### **4.1 Detailed Analysis of Environmental Impacts of the Alternatives**

##### **4.1.1 Effects of Feral and Free-Ranging Patas and Rhesus Monkey Populations on Human Health and Safety, Agriculture, Nuisance, and Native Wildlife**

###### **Alternative 1. No Action**

Under this alternative, WS would not be involved in WDM to reduce threats to human health and safety, agriculture, nuisance, and native wildlife from feral and free-ranging patas and rhesus monkeys in Puerto Rico. Threats to human and health safety, agriculture, nuisance, and native wildlife from feral and free-ranging patas and rhesus monkeys would continue, and potentially increase to higher levels, provided that city and/or natural resource managers or landowners did not implement their own WDM program. Efforts to reduce or prevent feral and free-ranging patas and rhesus monkey problems by city and/or natural resource managers or others could increase. This increase, potentially could result in impacts on human health and safety to an unknown degree. Impacts on human health and safety, agriculture, nuisance issues, and native wildlife under this alternative could be the same, less than, or more than those of the proposed action depending on the level of effort and the WDM skills and knowledge of the person implementing control methods.

## **Alternative 2. Nonlethal Control before Lethal Control**

Under this alternative, WS would implement and recommend nonlethal control prior to the use of lethal methods. Currently, the only nonlethal methods recommended or used by WS is exclusion using electric fences. It is likely that threats to human and health safety, agriculture, nuisance, and native wildlife would continue and many of the problem animals would not be successfully excluded from certain areas. It is probable, in many situations, that by the time all nonlethal methods were attempted and determined to be ineffective, the protected resource could be heavily impacted by feral and free-ranging patas and rhesus monkeys.

This alternative would likely be more effective at preventing or reducing threats and damage than Alternatives 1 and 3, but not as effective as Alternatives 4 and 5.

## **Alternative 3. Nonlethal Control Only**

Under this alternative, WS would only implement and recommend nonlethal control methods. Currently, the only nonlethal methods recommended or used by WS is exclusion using electric fences. Nonlethal methods could reduce threats to human health and safety, agriculture, nuisance issues, and native wildlife from feral and free-ranging patas and rhesus monkeys in some locations. This alternative might exclude some of the problem animals from select sites, however, not all animals could be excluded in all situations. Consequently, the threat to human and health safety, agriculture, nuisance, and native wildlife would still be present to an indeterminate degree. Threats and damage would likely continue, although possibly at a lower level.

This alternative potentially would be more effective at reducing threats to human and health safety, agriculture, nuisance, and native wildlife than Alternative 1, providing that some effective level of nonlethal management could be implemented. Otherwise, the effects on human and health safety, agriculture, nuisance, and native wildlife from this alternative would be similar to Alternative 1. This alternative would not be as effective in reducing human health and safety risks as Alternatives 2, 4, and 5.

## **Alternative 4. Lethal Control Only**

Under this alternative, WS would implement and recommend lethal control methods without applying or considering nonlethal methods. In most situations, lethal methods would be applied as a result of unsuccessful attempts by city and/or natural resource managers or landowners to alleviate feral and free-ranging patas and rhesus monkey problems through nonlethal methods. Threats to human and health safety, agriculture, nuisance, and native wildlife would likely be reduced or eliminated under this alternative, providing that lethal control methods could be safely and effectively implemented. In situations where lethal control could not be conducted, because of safety concerns or local ordinances, threats to human health and safety, agriculture, nuisance, and native wildlife could be expected to remain the same or increase. This alternative would likely be more effective at preventing or reducing threats to human and health safety, agriculture, nuisance, and native wildlife than Alternatives 1, 2, and 3, if some effective level of lethal management could be implemented. Otherwise, effects on human and health safety, agriculture, nuisance, and native wildlife from this alternative would be similar to Alternative 1. This alternative would likely not be as effective in reducing threats to human and health safety, agriculture, nuisance, and native wildlife as Alternative 5.

## **Alternative 5. Integrated Wildlife Damage Management (Proposed Action)**

Under this alternative, WS would incorporate select components from Alternatives 3 and 4 into its WDM program. WS could provide technical assistance and direct operational damage management, including non-lethal and lethal management methods by applying the WS Decision Model (Slate et al. 1992). When appropriate, physical exclusion (fencing) would be recommended and utilized to reduce damage. In other situations, monkeys would be removed as humanely as possible using shooting; and trapping and euthanasia. In determining the damage management strategy, preference would be given to practical and effective non-lethal methods. However, non-lethal methods may not always be applied as a first response to each damage problem. The most appropriate response could often be a combination of non-lethal and lethal methods, or could include instances where application of lethal methods alone would be the most appropriate strategy.

This alternative has the greatest potential of reducing threats to human and health safety, agriculture, nuisance, and native wildlife because all potential nonlethal and lethal control alternatives and methods would be available for use and recommendation by WS.

### **4.1.2 Effects on Target Species Populations**

#### **Alternative 1. No Action**

Under this alternative, WS would not be involved in WDM to reduce threats to human and health safety, agriculture, nuisance, and native wildlife from feral and free-ranging patas and rhesus monkeys in Puerto Rico. No impact would be experienced by any target species or population as a result of WS operations. Efforts by city and/or natural resource managers and other entities to reduce or prevent feral and free-ranging patas and rhesus monkey problems could increase, potentially resulting in impacts on target species populations to an unknown degree. City and/or natural resource managers, and other entities could implement any lethal or nonlethal control method(s) that are available to them. Impacts on target species under this alternative could be the same or less than those of the proposed action depending on the level of effort and the WDM skills and knowledge of the person implementing control methods.

#### **Alternative 2. Nonlethal Control before Lethal Control**

Under this alternative, WS would implement nonlethal control prior to the use of lethal methods. As stated in Alternative 4, WS lethal control actions would not negatively impact world-wide target species populations or the availability of patas and rhesus monkeys for the research community under this alternative. Feral and free-ranging patas and rhesus monkeys would be reduced or possibly eliminated in Puerto Rico; however, native patas and rhesus monkey populations in Africa and Asia are not expected to be negatively impacted in any way. Impacts under this alternative would be similar to Alternatives 5, providing that lethal control is implemented. Otherwise, impacts would be similar to Alternatives 3.

#### **Alternative 3. Nonlethal Control Only**

Under this alternative, WS would only implement nonlethal control methods. WS would exclude feral and free-ranging patas and rhesus monkeys from select areas using electric fencing. Feral and free-ranging patas and rhesus monkey populations would not be reduced in any areas of Puerto Rico by WS. However, city and/or natural resource managers, and other entities could still

resort to lethal control methods that are available to them. Fencing may restrict feral and free-ranging patas and rhesus monkey movement in certain areas, but this would be on a limited scale due to the financial resources of farmers and other entities involved. Impacts under this alternative would be less than Alternatives 2, 4, and 5, but more than Alternative 1.

#### **Alternative 4. Lethal Control Only**

Under this alternative, WS would implement and recommend lethal control methods without applying or considering nonlethal methods. In most situations, lethal methods would be applied as a result of unsuccessful attempts by city and/or natural resource managers or landowners to alleviate feral and free-ranging patas and rhesus monkey problems through nonlethal methods. The non-native patas and rhesus monkey populations in Puerto Rico would be reduced or possibly eliminated under this alternative. WS would not negatively impact target species populations in their native range in Africa and Asia under this alternative. Based on the best information available and the species proposed for control work, WS does not anticipate that its limited program on Puerto Rico will affect the world-wide monkey population or the availability of patas and rhesus monkeys for the research community under any of the alternatives. The species proposed for control is non-native (introduced species) to Puerto Rico, of Old World origin (or descendants of laboratory animals imported from India and Africa for medical research purposes), non-migratory, and considered common to abundant in the land of suspected origin (India/Africa).

Feral and free-ranging patas and rhesus monkeys are non-indigenous to Puerto Rico and often have negative impacts on the environment. Therefore, these monkeys are considered by many wildlife biologists and natural resource managers to be an undesirable component of wild and native ecosystems of Puerto Rico. Any reduction in Feral and free-ranging patas and rhesus monkey populations in Puerto Rico could be considered a beneficial impact to the environment.

#### **Alternative 5. Integrated Wildlife Damage Management (Proposed Action)**

Under this alternative, WS would incorporate select components from Alternatives 3 and 4 into its WDM program. The non-native patas and rhesus monkey populations in Puerto Rico would be reduced or possibly eliminated under this alternative. As stated in Alternative 4, WS would not negatively impact target species populations in their native range of Africa and Asia or the availability of patas and rhesus monkeys for the research community under this alternative. Impacts under this alternative would be similar to Alternatives 2 and 4, but potentially higher than Alternatives 1 and 3.

#### **4.1.3 Effects of Control Methods on Nontarget Species Populations, Including T&E Species**

##### **Alternative 1. No Action**

Under this alternative, WS would not be involved in feral and free-ranging patas and rhesus monkey WDM. No direct impacts would be experienced by any wildlife species or population as a result of WS. Efforts by city and/or natural resource managers and other entities could increase, which could result in impacts on nontarget species populations to an unknown degree. Impacts on nontarget species under this alternative could be the same, less than, or more than those of the proposed action depending on the level of effort and the WDM skills and knowledge of the person implementing control methods.

## **Alternative 2. Nonlethal Control before Lethal Control**

Under this alternative, WS would implement nonlethal control prior to the use of lethal methods. Impacts resulting from the implementation or recommendation of nonlethal control techniques and devices would be similar to Alternative 3; consequently, impacts associated with lethal control would be similar to Alternative 4.

## **Alternative 3. Nonlethal Control Only**

Under this alternative, WS would only implement nonlethal control methods. Exclusion (fencing) would have minimal to no negative impacts on nontarget and T&E species. WS SOP's and mitigation measures, as described in 3.3, would be followed to minimize potential impacts to nontarget and T&E species. WS has reviewed the list of T&E species for Puerto Rico and has determined that WS nonlethal monkey damage management activities will not likely adversely affect any species protected by the Puerto Rican Government or the United States Endangered Species Act. This determination was concurred by the Puerto Rican government and the USFWS.

Lethal control efforts by city and/or natural resource managers and other entities could increase, which could result in impacts on nontarget species populations to an unknown degree. Impacts on nontarget species under this alternative could be the same, less than, or more than those of the proposed action depending on the level of effort and the WDM skills and knowledge of the person implementing control methods.

## **Alternative 4. Lethal Control Only**

Under this alternative, WS would implement lethal control methods without applying nonlethal methods. WS take of non-target species during management activities is expected to be extremely low to non-existent. If take of nontarget animals would occur, these occurrences are rare and should not affect the overall populations of any species. WS has reviewed the list of T&E species for Puerto Rico and has determined that WS lethal monkey damage management activities will not likely adversely affect any species protected by the Puerto Rican Government or the United States Endangered Species Act. This determination was concurred by the Puerto Rican government and the USFWS.

Lethal removal by shooting is nearly 100% selective for target species, thus no nontarget or T&E species are expected to be lethally removed as a result in WS utilizing selective shooting under this alternative. Ground shooting during nighttime hours would not impact any T&E species from the use of lights to locate patas and rhesus monkeys. Potential impacts associated with spotlights would be minimized, when necessary, by use of appropriate night vision equipment, infrared devices, or red filtered spotlights. Human presence would be kept to the minimal time needed to accomplish the locating, shooting, and retrieval of monkeys. Impacts associated with firearm discharge and noise would be minimized through the use of suppressors and well trained personnel.

Live capture techniques would have minimal to no negative impacts on nontarget and T&E species. Nontarget animals that are inadvertently captured in live traps (drop-nets, cannon nets, legholds, cage traps, and snares) would be released if it is determined that it is safe to do so and if the animal is injury free. Nontarget risks are minimized by the selection of the appropriate trap

size, use of pan tension devices, selection of the appropriate attractant (bait), and proper site selection. Frequent trap checks will further minimize risks to nontarget animals. If nighttime operations are necessary, human presence would be kept to the minimum time necessary to conduct the operation. An exception to the time limitation would be to retrieve a captured animal. Risks associated with snares are greatest for animals that frequent the areas where snares are placed and travel along the paths of the target species. Nontarget risks would be minimized by adjusting the size of the loop and the height of placement. Proper loop size and placement allows animals smaller than the target species to pass through or under the device unharmed. The use of break away locks and stops (device used to prevent a snare from choking an animal) will allow animals larger than the target species to break free of the device and nontarget animals to be released. Hazards to nontarget animals associated with the use of snares could range from minor injuries or potential death due to strangulation. Snare use by employees experienced in targeting and capturing specific animals will further minimize risks to nontarget animals.

WS SOP's and mitigation measures, as described in 3.3, would be followed to minimize potential impacts to nontarget and T&E species.

### **Alternative 5. Integrated Wildlife Damage Management (Proposed Action)**

Under this alternative, WS would incorporate select components from Alternatives 3 and 4 into its WDM program. Impacts resulting from the implementation or recommendation of nonlethal control techniques and devices would be similar to Alternative 3. The potential effects of lethal techniques would be similar to Alternative 4.

#### **4.1.4 Humaneness of Control Techniques**

##### **Alternative 1. No Action**

Under this alternative, lethal methods, viewed as inhumane by some persons, would not be used by WS. Although WS would not perform any lethal activities under this alternative, city and/or natural resource managers and other entities would likely conduct WDM activities similar to those that would no longer be conducted by WS, resulting in impacts similar to the proposed action alternative. Impacts under this alternative could be the same, less than, or more than those of the proposed action, depending on the level of effort and the WDM skills and knowledge of the person implementing control methods.

##### **Alternative 2. Nonlethal Control before Lethal Control**

Under this alternative, WS would be required to implement nonlethal methods prior to the implementation of lethal methods. Impacts resulting from the implementation or recommendation of nonlethal control techniques and devices would be similar to Alternative 3; consequently, impacts associated with lethal control would be similar to Alternative 4.

##### **Alternative 3. Nonlethal Control Only**

Under this alternative, lethal methods, viewed as inhumane by some persons, would not be used by WS. WS would implement nonlethal control methods only. Nonlethal methods could include exclusion via electric fencing. Persons opposed to restricting an animal's movement (i.e., electric fencing) would consider this alternative inhumane. Others that view lethal control of any kind as inhumane would most likely prefer this alternative to Alternatives 2, 4, and 5. WS

personnel are experienced and professional in their use of control methods and use these methods in the most humane manner possible. Mitigation measures and SOPs used to maximize humaneness are listed in Chapter 3.

Although WS would not perform any lethal activities under this alternative, city and/or natural resource managers and other entities would likely conduct WDM activities similar to those that would no longer be conducted by WS, resulting in impacts similar to the proposed action alternative.

#### **Alternative 4. Lethal Control Only**

Wildlife damage management methods viewed by some persons as inhumane would be employed by WS under this alternative. WS would implement lethal control methods without applying and considering nonlethal methods. Lethal methods would generally be applied as a result of unsuccessful attempts by resource managers and landowners to alleviate patas and rhesus monkey damage through nonlethal methods. Lethal methods would consist of selective shooting and live trapping followed by euthanasia. When performed by experienced professionals, shooting usually results in a quick death for the selected animal. WS personnel are experienced and professional in their use of control methods and use these methods in the most humane manner possible. Mitigation measures and SOPs used to maximize humaneness were listed in Chapter 3.

Some segments of the public would view the shooting or killing of an animal as inhumane. Persons or publics who view killing of any kind as inhumane would strongly oppose this alternative. Groups that are opposed to trapping and/or restraining of animals in traps and snares would also consider this alternative inhumane.

#### **Alternative 5. Integrated Wildlife Damage Management (Proposed Action)**

Under this alternative, WS would incorporate select components from Alternatives 3 and 4 into its WDM program. Impacts resulting from the implementation or recommendation of nonlethal control techniques and devices would be similar to Alternative 3; consequently, impacts associated with lethal control would be similar to Alternative 4.

### **4.1.5 Effects of Control Methods on Human Health and Safety**

#### **Alternative 1. No Action**

Under this alternative, WS would not be involved in WDM to reduce threats to human health and safety, nuisance issues, and predation on native wildlife by feral and free-ranging cats. Risks to human safety from WS's use of firearms and trapping devices would be alleviated because no such use would occur. Therefore, WS damage control activities and methods would have no impact on human health and safety.

However, efforts by other individuals (non-WS) to reduce or prevent damage would be expected to increase, resulting in less experienced persons implementing damage management methods and potentially leading to greater risk to human health and safety than the proposed action alternative. These persons would be able to use traps, snares or firearms in WDM programs and this activity would likely occur to a greater extent in the absence of WS assistance. Hazards to humans could be greater under this alternative if personnel conducting WDM activities are



poorly or improperly trained. WS would not provide assistance to these individuals in the safe and proper use of WDM control devices under this alternative. Risks to human safety under this alternative could increase or remain the same as Alternative 5.

#### **Alternative 2. Nonlethal Control before Lethal Control**

Under this alternative, WS would be required to implement nonlethal methods prior to the implementation of lethal methods. Impacts resulting from the implementation or recommendation of nonlethal control techniques and devices would be similar to Alternative 3; consequently, impacts associated with lethal control would be similar to Alternative 4.

#### **Alternative 3. Nonlethal Control Only**

Under this alternative, WS would implement and recommend nonlethal control methods only. WDM methods that might raise safety concerns is the use of electric fencing to exclude patas and rhesus monkeys. WS personnel receive safety training on an annual basis to keep them aware of safety concerns. Mitigation measures and SOPs used to maximize safe use of control methods were listed in Chapter 3. A formal risk assessment of WS's operational management methods, including exclusion devices (fences), found that risks to human safety were low (USDA 1997, Appendix P). Therefore, no adverse impacts on human safety from WS's use of these methods are expected.

Although WS would not perform any lethal activities under this alternative, city and/or natural resource managers and other entities would likely conduct WDM activities similar to those that would no longer be conducted by WS, resulting in impacts similar to Alternative 1.

#### **Alternative 4. Lethal Control Only**

Under this alternative, WS would implement lethal control methods without applying or considering any nonlethal methods. Lethal methods would generally be applied as a result of unsuccessful attempts by resource managers and landowners to alleviate patas and rhesus monkey damage through nonlethal methods. WDM methods that might raise safety concerns include shooting with firearms and the use of traps and snares.

Firearms, traps and snares are only used by WS personnel who are experienced in the safe handling and operation of such devices. WS personnel receive firearms safety training on an annual basis to keep them aware of safety concerns. The Puerto Rico WS program has not had any accidents involving the use of firearms, traps, or snares in which a member of the public was harmed. Mitigation measures and SOPs used to maximize safe use of control methods are listed in Chapter 3. A formal risk assessment of WS's operational management methods, including the use of firearms and trapping devices, found that risks to human safety were low (USDA 1994, Appendix P). Therefore, no adverse impacts on human safety from WS's use of these methods is expected.

#### **Alternative 5. Integrated Wildlife Damage Management (Proposed Action)**

Under this alternative, WS would incorporate select components from Alternatives 3 and 4 into its WDM program. Impacts resulting from the implementation or recommendation of nonlethal control techniques and devices would be similar to Alternative 3; consequently, impacts associated with lethal control would be similar to Alternative 4.

#### **4.1.6 Effects on the Aesthetic Values of Targeted Species and Protected Wildlife Species**

##### **Alternative 1. No Action**

Under this alternative, WS would not conduct any lethal or nonlethal feral and free-ranging patas and rhesus monkey WDM activities. Some people and/or groups who oppose any wildlife damage control by government agencies or other groups and individuals would support this alternative. People or groups who have affectionate bonds with individual primates and primates in general, would not be affected by WS activities as stated in this alternative. However, it is likely that city and/or natural resource managers and other entities would conduct similar WDM, resulting in impacts similar to Alternative 5.

Conversely, if city and/or natural resource managers and other entities did not take action, large segments of the public who value native wildlife would be impacted negatively because of the continued impact of feral and free-ranging patas and rhesus monkeys on native wildlife species, including T&E species.

##### **Alternative 2. Nonlethal Control before Lethal Control**

Under this alternative, WS would conduct nonlethal control methods prior to carrying out lethal control. Impacts resulting from the implementation or recommendation of nonlethal control techniques and devices would be similar to Alternative 3; consequently, impacts associated with lethal control would be similar to Alternative 4. It is important to note, that prior to WS involvement, most agencies and citizen groups involved in feral and free-ranging patas and rhesus monkey management have exhausted the use of nonlethal control methods. Some segments of the public are concerned about the welfare and potential impacts of lethal WDM methods on feral and free-ranging patas and rhesus monkeys. These publics would likely favor this alternative, since lethal control would not be used until all nonlethal control methods were exhausted.

The requirement for WS to implement all nonlethal methods before lethal control would prolong the threats to native wildlife, including T&E species from feral and free-ranging primates. Publics concerned with native wildlife protection would be negatively impacted, because of the continued level of predation.

Overall, impacts of this alternative on target species would be similar to Alternatives 5; conversely, the negative impacts to native wildlife would be greater than Alternatives 4 and 5 and similar to Alternatives 1 and 3.

##### **Alternative 3. Nonlethal Control Only**

Under this alternative, WS would implement and recommend nonlethal control methods only. WS would only be allowed to use exclusion devices to reduce threats associated with feral and free-ranging patas and rhesus monkeys. Persons whom are concerned with the welfare and potential impacts to feral and free-ranging patas and rhesus monkeys would likely favor this alternative since no lethal methods would be used by WS. Although WS would not perform any lethal activities under this alternative, city and/or natural resource managers and other entities would likely conduct WDM activities similar to those that would no longer be conducted by WS, resulting in impacts similar to the proposed action alternative.

The requirement for WS to implement nonlethal methods only would prolong threats native wildlife, including T&E species in many circumstances. If city and/or natural resource managers and other entities did not take lethal action when nonlethal methods were ineffective, publics concerned with the protection of native wildlife would be negatively impacted because of the continued, and potentially elevated threats from increasing populations of feral and free-ranging primates.

Overall, impacts of this alternative on target species would be slightly greater than Alternative 1 and less than Alternatives 2, 4, and 5. Negative impacts to native wildlife would be greater than Alternatives 4 and 5 and similar to Alternatives 1 and 2.

#### **Alternative 4. Lethal Control Only**

Under this alternative, WS would implement and recommend lethal control methods without applying or considering nonlethal methods. Some people have expressed opposition to the killing of any animals during WDM activities. Under this alternative lethal control of feral and free-ranging patas and rhesus monkeys would occur and these persons would continue to be opposed. However, many persons who voice opposition have no direct connection or opportunity to view or enjoy the particular animals that would be killed by WS's lethal control activities. Lethal control actions would generally be restricted to local sites and areas where the primates occur. It would have no effect on zoo or animal park animals or native patas or rhesus monkeys in Africa and Asia. Therefore, the species subjected to limited lethal control actions would remain common and abundant in its native range; therefore, these animals (as a species) would still be available for viewing by persons with that interest. Some segments of the public are concerned about the welfare and potential impacts to feral and free-ranging patas and rhesus monkeys. These publics would not likely favor this alternative, but would favor alternatives 1 and 3, since no patas or rhesus monkeys would be lethally removed and euthanized by WS.

Public concern with threats to native wildlife, including T&E species would be reduced under this alternative.

Overall, impacts of this alternative on target species would be similar to Alternatives 2 and 5. Negative impacts to native wildlife would be less than Alternatives 1, 2, and 3 and similar to Alternative 5.

#### **Alternative 5. Integrated Wildlife Damage Management (Proposed Action)**

Under this alternative, WS would incorporate select components from Alternatives 3 and 4 into its WDM program. Impacts resulting from the implementation or recommendation of nonlethal control techniques and devices would be similar to Alternative 3; consequently, impacts associated with lethal control would be similar to Alternative 4.

Potential impacts to feral and free-ranging patas and rhesus monkeys would be similar to Alternatives 2 and 3. Negative impacts to native wildlife would be less than Alternatives 1, 2, and 3 and similar to Alternative 4.

## **4.2 CUMULATIVE IMPACTS**

Cumulative impacts, as defined by CEQ (40 CFR 1508.7), are impacts to the environment that result from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions, regardless of what agency (federal or non-federal) or person undertakes such other actions. Cumulative impacts may result from individually minor, but collectively significant, actions taking place over time. No significant or cumulative adverse environmental consequences resulting from the proposed action are anticipated.

Under Alternatives 2, 3, 4 and 5, WS would address damage associated with feral and free-ranging patas and rhesus monkeys in a number of situations throughout the Commonwealth of Puerto Rico. Wildlife Services would be the primary federal program with WDM responsibilities; however, some other government agencies may conduct WDM activities on feral and free-ranging patas and rhesus monkeys in Puerto Rico as well. Through ongoing coordination with these agencies, WS is aware of such WDM activities and may provide technical assistance in such efforts.

Methods used or recommended by WS MDM program may include exclusion, live capture and euthanasia, trapping, snaring, and shooting. No cumulative impacts from WS use of these methods are expected.

Control activities will not negatively impact native flora or fauna. Federal and Puerto Rican wildlife agencies were contacted concerning the Proposed Action and reviewed this document concerning any potentially negative impacts to the environment. No threatened or endangered species or critical habitat would be adversely impacted by the proposed action. Therefore, WS with concurrence from the USFWS, has determined that the proposed action would not likely adversely affect any species protected under the U.S. Endangered Species Act. Overall impacts to native populations of patas and rhesus monkeys in Africa and Asia are expected to be nonexistent. Management actions would only be directed towards feral and free-ranging patas and rhesus monkeys residing in the Commonwealth of Puerto Rico and its satellite islands. Direct impacts to captive-kept primates would be minimal to none. It is expected that threats to human health and safety, agriculture, nuisance, and native wildlife from feral and free-ranging patas and rhesus monkeys would be decreased and possibly eliminated.

## **SUMMARY**

No significant cumulative environmental impacts are expected from any of the 5 alternatives. Under the Proposed Action, the lethal removal of feral and free-ranging patas and rhesus monkeys by WS would not have significant impacts on the world-wide monkey population or the availability of patas and rhesus monkeys for the research community. No risk to public safety is expected when WS's services are provided and accepted by requesting individuals in Alternatives 2, 3, 4 and 5, since only trained and experienced wildlife biologists/specialists would conduct and recommend WDM activities. There is a slight increased risk to public safety when persons who reject WS assistance and recommendations in Alternatives 2, 3, 4 and 5 and conduct their own WDM activities, and when no WS assistance is provided in Alternative 1. In all 5 Alternatives, however, it would not be to the point that the impacts would be significant. Although some persons will likely be opposed to WS's participation in feral and free-ranging patas and rhesus monkey WDM activities in the Commonwealth of Puerto Rico, the analysis in this EA indicates that WS IWDW program will not result in significant cumulative adverse impacts on the quality of the human environment. Table 4-4 summarizes the expected impact of each of the alternatives on each of the issues.

Table 4-4. Summary of the potential effects of the Alternatives as it pertains to the identified Issues. Potential effects include both positive and negative, when applicable.

ISSUES	ALTERNATIVE 1. NO ACTION	ALTERNATIVE 2. NONLETHAL CONTROL BEFORE LETHAL CONTROL	ALTERNATIVE 3. NONLETHAL CONTROL ONLY	ALTERNATIVE 4. LETHAL CONTROL ONLY	ALTERNATIVE 5. INTEGRATED WILDLIFE DAMAGE MANAGEMENT (PROPOSED ACTION)□
EFFECTS OF FERAL AND FREE-RANGING PATAS AND RHESUS MONKEYS ON HUMAN HEALTH AND SAFETY, AGRICULTURE, NUISANCE, AND NATIVE WILDLIFE	Moderate to High impacts of feral & free-ranging monkeys on human health and safety, agriculture, nuisance, and native wildlife in many areas of Puerto Rico. Monkey damage and conflicts less likely to be resolved without WS involvement.	Moderate to High initial impacts of feral & free-ranging monkeys on human health and safety, agriculture, nuisance, and native wildlife in many areas of Puerto Rico. Impacts would be reduced once lethal control was initiated.	Moderate to High impacts of feral & free-ranging monkeys on human health and safety, agriculture, nuisance, and native wildlife in many areas of Puerto Rico. This alternative would maintain or increase the current impacts of monkeys on human health and safety, agriculture, nuisance, and native wildlife.	Low to No Negative Impact to human health and safety, agriculture, nuisance, and native wildlife. This alternative would alleviate human health and safety, agriculture, nuisance, and native wildlife issues concerning monkeys.	Low to No Negative Impact to human health and safety, agriculture, nuisance, and native wildlife. This alternative would alleviate human health and safety, agriculture, nuisance, and native wildlife issues concerning monkeys.
EFFECTS ON TARGET SPECIES POPULATIONS	No Impact would occur from WS.	Impacts under this alternative would be similar to Alternative 5, providing that lethal control is implemented. Otherwise, impacts would be similar to Alternative 3. Feral and free-ranging monkey populations would be reduced in certain areas through the use of exclusionary devices. However, no monkeys would be killed by WS under this alternative. Native patas and rhesus populations in Old World are not expected to be negatively impacted in any way.	Impacts under this alternative would be less than Alternatives 2, 4, and 5, but more than 1. Feral, and free-ranging monkey populations would be reduced in certain areas through the use of exclusionary devices. However, no monkeys would be killed by WS under this alternative. Native patas and rhesus populations in Old World are not expected to be negatively impacted in any way.	Impacts under this alternative would be similar to Alternatives 2 and 5, but potentially higher than 3. Feral and free-ranging monkey populations would be reduced or possibly eliminated in certain areas. Native patas and rhesus populations in Old World are not expected to be negatively impacted in any way.	Impacts under this alternative would be similar to Alternatives 2 and 4, but potentially higher than 1 and 3. Feral and free-ranging monkey populations would be reduced or possibly eliminated in certain areas. Native patas and rhesus populations in Old World are not expected to be negatively impacted in any way.
EFFECTS OF CONTROL METHODS ON NONTARGET SPECIES POPULATIONS, INCLUDING T&E SPECIES	No Impact would be observed with any nontarget or T&E species as a result of WS.	Low Impact. Methods used by WS would be highly selective with very little risk to non-target	Low Impact. Methods used by WS would be highly selective with very little risk to non-target	Low Impact. Methods used by WS would be highly selective with very little risk to non-target species.	Low Impact. Methods used by WS would be highly selective with very little risk to non-target

		species. All traps proposed for use are live capture devices; any nontarget animal captured will be released, whenever possible.	species. The use of exclusionary devices present minimal to no possible effect on nontarget species	species. All traps proposed for use are live capture devices; any nontarget animal captured will be released, whenever possible.	species. All traps proposed for use are live capture devices; any nontarget animal captured will be released, whenever possible.
HUMANENESS OF CONTROL TECHNIQUES	No Impact by WS.	Low to Moderate Impact - potentially greater than Alternatives 1 & 3, but as humane as possible with the available resources and technologies. WDM methods viewed by some people as inhumane would be used by WS	Low to Moderate Impact - potentially less than Alternatives 2, 4, & 5. Some components of the public would favor this alternative to lethal control.	Low to Moderate Impact - potentially greater than Alternatives 1 & 3, but as humane as possible with the available resources and technologies. WDM methods viewed by some people as inhumane would be used by WS	Low to Moderate Impact - potentially greater than Alternatives 1 & 3, but as humane as possible with the available resources and technologies. WDM methods viewed by some people as inhumane would be used by WS
EFFECTS OF CONTROL METHODS ON HUMAN HEALTH AND SAFETY	No Impact by WS.	Low Risk or Impact - no potential Human Health and Safety issues would be created by the WS operational program. Low risk from methods used by WS.	Low Risk or Impact - no potential Human Health and Safety issues would be created by the WS operational program. Low risk from methods used by WS.	Low Risk or Impact - no potential Human Health and Safety issues would be created by the WS operational program. Low risk from methods used by WS.	Low Risk or Impact - no potential Human Health and Safety issues would be created by the WS operational program. Low risk from methods used by WS.
EFFECTS ON THE AESTHETICS VALUES OF TARGETED SPECIES AND PROTECTED WILDLIFE SPECIES	No Impact by WS - feral and free-ranging monkey populations would not be affected; however, High Impact for T&E and wildlife species. The aesthetics of T&E species and native wildlife species would be adversely affected by this Action.	Low to Moderate Impact - feral and free-ranging monkey populations would be reduced or possibly eliminated in certain areas. Native patas and rhesus populations in Old World are not expected to be negatively impacted in any way. High initial negative impact for T&E and wildlife species until the implementation of lethal control techniques.	Impacts of this alternative on target species would be slightly greater than Alternative 1 and less than Alternatives 2, 4, and 5. Negative impacts to wildlife species would be greater than Alternatives 4 and 5 and similar to Alternatives 1 and 2. High negative impact for T&E and wildlife species.	Low to Moderate Impact - feral and free-ranging monkey populations would be reduced or possibly eliminated in certain areas. Native patas and rhesus populations in Old World are not expected to be negatively impacted in any way. High positive impact for T&E and wildlife species, due to alleviation of predation.	Low Impact - feral and free-ranging monkey populations would be reduced or possibly eliminated in certain areas. Native patas and rhesus populations in Old World are not expected to be negatively impacted in any way. High positive impact for T&E and wildlife species, due to alleviation of predation.

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## APPENDIX A. BIBLIOGRAPHY AND LITERATURE CITED

- Anonymous. 2000. Monkeys with herpes B virus culled at a safari park. *Commun. Dis. Rep. CDR*: 10(11): 99, 102.
- Angst, W. 1975. Basic data and concepts on the social organization of *Macaca fascicularis*. *Primate Beh.* 4: 325-388.
- Applied Occupational and Environmental Hygiene. 2001. Hazard ID: *Cercopithecine herpesvirus 1* (B Virus) infection resulting from ocular exposure. *Appl. Occup. Environ. Hyg.* 16: 32-34.
- Bailey, J.A. 1984. *Principles of wildlife management*. John Wiley and Sons, New York, New York. 373pp.
- Ball, H. L. Close encounters: Interactions between rhesus macaque females and strange males. *Ame. J. Phys. Anthropol. Suppl.* 22: 64, 1996. (Abstract).
- \_\_\_\_\_. Haven't we met? Interactions between rhesus macaque females and returning male immigrants. *Primate Eye* 59: 13-14, 1996 (Abstract).
- Bangjie, T. 1985. The status of primates in China. *Primate Conserv.* 5: 63-81.
- Baulu, J., C. O. R. Everard, and J. D. Everard. 1987. Leptospiruses in vervet monkeys (*Cercopithecus aethiops sabaues*) on Barbados. *J. Wildl. Diseases* 23: 60-66.
- Beaver, B. V., W. Reed, S. Leary, B. McKiernan, F. Bain, R. Schultz, B. T. Bennett, P. Pascoe, E. Shull, L. C. Cork, R. Franis-Floyd, K. D. Amass, R. Johnson, R. H. Schmidt, W. Underwood, G. W. Thorton, and B. Kohn. 2001. 2000 Report of the AVMA Panel on Euthanasia. *J. Am. Vet. Med. Assoc.* 218: 669-696.
- Benirschke, K. 1986. *Primates: The road to self-sustaining populations*. Springer-Verlag, New York. 1044 pp.
- Berard, J. D. 1989. Life histories of male Cayo Santiago macaques. Pages 61-64 in M. J. Kessler, ed. Proceedings of the Meeting to Celebrate the 10<sup>th</sup> Anniversary of the Cayo Santiago Rhesus Monkey Colony. *Puerto Rico Health Science J.* 8: 61-64.
- \_\_\_\_\_. 1989. Lifetime migration patterns for rhesus macaque males on Cayo Santiago. *Am. J. Primatol.* 18: 134-135. Abstract.
- \_\_\_\_\_. 1990. Juvenile dispersal: Maintaining relationships in a changing world. *Am. J. Primatol.* 20: 172-173. Abstract.
- \_\_\_\_\_. 1991. Life history patterns of male rhesus macaques on Cayo Santiago. *Dissert. Abst. Internat.* A52: 208.
- \_\_\_\_\_. 1999. A four-year study of the association between male dominance rank, residency status and reproductive activity in rhesus macaques (*Macaca mulatta*). *Primates* 40: 163-178.
- \_\_\_\_\_, P. Nurnberg, J. T. Epplen, and J. Schmidtke. 1993. Male rank, reproductive behavior and



- reproductive success in free-ranging rhesus macaques. *Primates* 34: 481-489.
- \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, and \_\_\_\_\_. 1994. Alternative reproductive tactics and reproductive success in male rhesus macaques. *Behaviour* 129: 177-201.
- \_\_\_\_\_, J. Schmidtke, and L. McGeehan. 1990. Male reproductive success in a free-ranging colony of rhesus macaques. *Am. J. Primatol.* 20: 173. Abstract.
- Bercovitch, F. B. 1991. Mate selection, consortship formation and reproductive tactics in adult female savanna baboons. *Primates* 32: 437-452.
- \_\_\_\_\_. 1993. Dominance rank and reproductive maturation in male rhesus macaques (*Macaca mulatta*). *J. Reprod. Fert.* 99: 113-120.
- \_\_\_\_\_. 1995. Female cooperation, consortship maintenance and male mating success in savanna baboons. *Anim. Behav.* 50: 137-149.
- \_\_\_\_\_. 1996. Testicular and scrotal coloration in patas monkeys. *J. Zool.* 239:93-100.
- \_\_\_\_\_. 1997. Reproductive strategies of rhesus macaques. *Primates* 38: 247-263.
- \_\_\_\_\_ and J. D. Berard. 1993. Life history costs and consequences of rapid reproductive maturation in female rhesus macaques. *Behav. Ecol. Sociobiol.* 32: 103-109.
- \_\_\_\_\_ and A. S. Clarke. 1995. Dominance rank, cortisol concentrations and reproductive maturation in male rhesus macaques. *Physiol. Behav.* 58: 215-221.
- \_\_\_\_\_ and R. S. O. Harding. 1993. Annual birth patterns of savanna baboons (*Papio cynocephalus anubis*) over a ten-year period at Gilgil, Kenya. *Folia Primatol.* 61: 115-122.
- \_\_\_\_\_, M. D. Hauser, J. H. Jones. The endocrine stress response and alarm vocalizations in rhesus macaques. *Anim. Behav.* 49: 1703-1706.
- \_\_\_\_\_, J. F. Rodriguez, P. Nieves, C. A. Ortiz, A. Chardon, and M. J. Kessler. 1992. A non-invasive technique for control of intestinal parasites in rhesus macaques (*Macaca mulatta*)
- \_\_\_\_\_ and S. C. Strum. 1993. Dominance rank, resource availability and reproductive maturation among female savanna baboons. *Behav. Ecol. Sociobiol.* 33: 313-318.
- Berman, C. M. 1989. Trapping activities and mother-infant relationships on Cayo Santiago: A cautionary tale. Pages 73-78 in M. J. Kessler, ed. Proceedings of the Meeting to Celebrate the 50<sup>th</sup> Anniversary of the Cayo Santiago Rhesus Monkey Colony. Puerto Rico Health Science J. 8: 73-78.
- \_\_\_\_\_, K. L. R. Rasmussen, and S. J. Suomi. 1997. Group size, infant development and social networks in free-ranging rhesus monkeys. *Anim. Behav.* 53: 405-421.
- Berryman, J.H. 1991. Animal damage management: responsibilities of various agencies and the need for coordination and support. *Proc. East Wild. Damage Control Conf.* 5:12-14.

- Bishop, R. C. 1987. Economic values defined. Pages 24-33 in D. J. Decker and G. R. Goff, eds. Valuing wildlife: Economic and social perspectives. Westview Press. Boulder, CO. 424 pp.
- Bouvier, M. 1988. Age estimation in rhesus macaques (*Macaca mulatta*) based on mandibular dimensions. *Am. J. Primatol.* 15: 129-142.
- Busse, C. D. and J. Berard. 1986. Demography of the Cayo Santiago rhesus monkey colony, 1956-1986. *Am. J. Primatol.* 10: 392. Abstract.
- Centers for Disease Control and Prevention. 1987. Guidelines for prevention of *Herpesvirus simiae* (B virus) infection in monkey handlers. *MMWR* 36: 680-682, 687-689.
- \_\_\_\_\_. 1989. Ebola virus infection in imported primates – Virginia, 1989. *MMWR* 38(48): 831-832, 837-838.
- \_\_\_\_\_. 1990. Update: Filovirus infection associated with contact with nonhuman primates or their tissues. *MMWR* 39(24): 404-405.
- \_\_\_\_\_. 1998. B-virus from pet macaque monkeys: an emerging threat in the United States? *Emerging Infectious Diseases* 4(1): 5 pp.
- \_\_\_\_\_. 2000. Monkeys with herpes B virus culled at a safari park. *Commun. Dis. Rep. CDR Wkly.* 10: 99, 102.
- \_\_\_\_\_. 2002. Risk to human health from a plethora of simian immunodeficiency viruses in primate bushmeat. *Emerging Infectious Diseases* 8(5): 12 pp.
- Chism, J. and T. E. Rowell. 1988. The natural history of patas monkeys. Pages 412-438 in A. Gautier-Hion, ed. A primate radiation: evolutionary biology of the African guenons. Cambridge University Press, New York. 567 pp.
- Cogswell, F. B. 2000. Malaria and piroplasms of non-human primates. International Veterinary Information Service, Ithaca, NY ([www.ivis.org](http://www.ivis.org)), 2000: A0304.0600. 16 pp.
- Cohen, J. I., D. S. Davenport, J. A. Stewart, S. Deitchman, J. K. Hilliard, and L. E. Chapman. 2002. Recommendations for prevention of and therapy for exposure to B virus (*Cercopithecine herpesvirus* 1). *Clin. Infect. Dis.* 35: 1191-1203.
- Datta, S. 1988. Demographic influences on dominance structure among female primates. *Primate Eye* 35: 11-12. Abstract.
- Day, D. 1981. The Doomsday Book Of Animals. Viking Press, New York. 288 pp.
- Deag, J. M. 1977. The status of the Barbary macaque *Macaca sylvanus* in captivity and factors influencing its distribution in the wild. Pages 267-287 in Rainer III, Prince of Monaco and G. H. Bourne, eds. Primate Conservation. Academic Press, New York. 658 pp.
- Decker, D. J. and G. R. Goff. 1987. Valuing Wildlife: Economic and social perspectives. Westview Press. Boulder, CO. 424 pp.

- Denham, W. W. 1987. West Indian green monkeys: problems in historical biogeography. Karger, New York. 78 pp.
- De Vinney, B. J., C. M. Berman, and K. L. R. Rasmussen. 1998. Weaning and maternal responsiveness to distress calling among free-ranging rhesus monkeys on Cayo Santiago. *Am. J. Primatol.* 45: 176-177. Abstract.
- Dittus, W. 1977. The socioecological basis for the conservation of the toque monkey (*Macaca sinica*) of Sri Lanka (Ceylon). Pages 237-265 in Rainer III, Prince of Monaco and G. H. Bourne, eds. Primate Conservation. Academic Press, New York. 658 pp.
- Dobson, A. P. 1988. Restoring island ecosystems: the potential of parasites to control introduced mammals. *Conserv. Biol.* 2(1): 31-39.
- Dunbar, D. C. and R. G. Rawlins. 1989. Aboreal locomotor behavior of juvenile rhesus macaques on Cayo Santiago. *Am. J. Phys. Anthropol.* 78: 215. Abstract.
- Eason, C. T., D. R. Morgan, and B. K. Clapperton. 1992. Toxic baits and baiting strategies for feral cats. Pages 371-376 in Borrecco, J. E. and R. E. Marsh, eds. Proc. 15th Vertebrate Pest Conf. Univ. of California, Davis. 415 pp.
- Eisenberg, J. F. 1981. Techniques for the study of primate population ecology. National Academy Press, Washington, D. C. 233 pp.
- Engel, G. A., L. Jones-Engel, M. A. Schillaci, K. G. Suaryana, A. Putra, A. Fuentes, and R. Henkel. 2002. Human exposure to herpesvirus B-seropositive macaques, Bali, Indonesia. *Emerg. Infect. Dis.* 8(8): 789-795.
- Enstam, K. L., L. A. Isbell, and T. W. De Maar. 2002. Male demography, female mating behavior, and infanticide in wild patas monkeys (*Erythrocebus patas*). *International J. Primatology* 23(1): 85-104.
- Eudey, A. A. 1987. Action plan for Asian primate conservation: 1987-1991. Internatl. Union Conserv. Nat., Gland, Switzerland. 65pp.
- Evans, M. A. 1987. Ecology and removal of introduced rhesus monkeys: Desecheo Island National Wildlife Refuge, Puerto Rico. Bachelor of Arts, Thesis. 99 pp.
- \_\_\_\_\_. 1989. Ecology and removal of introduced rhesus monkeys: Desecheo Island National Wildlife Refuge, Puerto Rico. Pages 139-156 in M. J. Kessler, ed. Proceedings of the Meeting to Celebrate the 50<sup>th</sup> Anniversary of the Cayo Santiago Rhesus Monkey Colony. Puerto Rico Health Science J. 8: 139-156.
- Ewel, J. J. and J. L. Whitmore. 1973. The ecological life zones of Puerto Rico and the U.S. Virgin Islands. Forest Service Research Paper ITF- 118, USDA. 72 pp.
- File, S. and M. J. Kessler. 1989. Parasites of free-ranging Cayo Santiago macaques after 46 years of isolation. *Am. J. Primatol.* 18: 231-236.

- Fooden, J. 1979. Taxonomy and evolution of the sinica group of Macaques. I Species and subspecies accounts of *Macaca sinica*. *Primates* 10: 109-140.
- \_\_\_\_\_. 1982. Ecogeographic segregation of macaque species. *Primates* 23: 574-579.
- Fowler, M.E. and R.E. Miller. 1999. *Zoo and Wild Animal Medicine*. W.B. Saunders Co. Philadelphia, PA
- Fukuda, L. K. 1995. The prosocial behaviors of rhesus monkeys (*Macaca mulatta*) of Cayo Santiago, Puerto Rico. *Masters Absts.* 33: 367. Abstract.
- Gonzalez-Martinez, J. 1992. The feral primates of southwestern Puerto Rico. *Am. J. Primatol.* 27:31. Abstract.
- \_\_\_\_\_. 1995. Ecology of the introduced free-ranging patas and rhesus monkeys of southwestern Puerto Rico. *Dissert. Abst.* 158 pp.
- \_\_\_\_\_. 1995. Ecology of the introduced free-ranging patas and rhesus monkeys of Southwestern Puerto Rico. Ph.D. Thesis, University of Colorado-Boulder. 158 pp.
- \_\_\_\_\_. 1996. Ecology of the introduced free-ranging patas and rhesus monkeys of southwestern Puerto Rico. *Dissert. Absts. Internat.* B57 (1): 68.
- \_\_\_\_\_. 1996. Development of a program to mitigate crop damage by monkeys and to contain and monitor their populations. A proposal submitted to the UPR/MS, PRDA, and PR DNER. Caribbean Primate Research Center. 13 pp.
- \_\_\_\_\_. 1998. The ecology of introduced patas monkey (*Erythrocebus patas*) population of southwestern Puerto Rico. *Am. J. Primatol.* 45: 351-365.
- \_\_\_\_\_, S. Emperador, M. J. Kessler, and J. Rodriguez. 2002. Health status of the free-ranging primates populations of southwestern Puerto Rico. Presented at: Biomedical Research Forum April 18-19, University of Puerto Rico School of Medicine.
- \_\_\_\_\_ and M. J. Kessler. 1997. Surgical sterilization as a means of population control for a free-ranging introduced primate population in southwest Puerto Rico. *Puerto Rico Health. Science J.* 16: 198. Abstract.
- Gore, M. A. 1993. A comparison of morphometry from captive and free-ranging *Macaca mulatta*. *J. Med. Primatol.* 22: 360-367.
- Green, S. and K. Minkowski. 1977. The lion-tailed monkey and its South Indian forest habitat. Pages 289-337 in Rainer III, Prince of Monaco and G. H. Bourne, eds. Primate Conservation. Academic Press, New York. 658 pp.
- Gruver, K. S., R. L. Philips, and E. S. Williams. 1996. Leg injuries to coyotes captured in standard and modified Soft Catch traps. *Proc. Vertebr. Pest. Conf.* 17.
- Hall, K. R. 1965. Behaviour and ecology of the wild patas monkey, *Erythrocebus patas*, in Uganda. Pages 32-119, in P. C. Jay, ed. Primates: studies in adaptation and variability. Holt, Rinehart, and Winston, New York. 569 pp.

- Harding, R. S. O. and D. K. Olson. 1986. Patterns of mating among male patas monkeys (*Erythrocebus patas*). *Am. J. Primatol.* 11: 343-358.
- Harpending, H. and S. Cowan. 1986. Primate population structure: Evaluation of models. *Am. J. Phys. Anthropol.* 70: 63-68.
- Hauser, M. D. 1991. Sources of acoustic variation in rhesus macaque (*Macaca mulatta*) vocalizations. *Ethology* 89: 29-46.
- \_\_\_\_\_. 2001. Searching for food in the wild: A nonhuman primate's expectations about invisible displacement. *Developmental Science* 4(1): 84-93.
- \_\_\_\_\_ and P. Marler. 1993. Food-associated calls in rhesus macaques (*Macaca mulatta*): I. Socioecological factors. *Behav. Ecol.* 4: 194-205.
- \_\_\_\_\_ and \_\_\_\_\_. 1993. Food-associated calls in rhesus macaques (*Macaca mulatta*): II. Costs and benefits of call production and suppression. *Behav. Ecol.* 4: 206-212.
- \_\_\_\_\_, ManNeilage, P., and Ware, M. 1996. Numerical representations in primates. *Proc. Nat. Acad. Sci. U.S.A.* 93: 1514-1517.
- Hausfater, G. 1974. History of three little-known New World populations of macaques. *Lab. Primate Newsl.* 13(1): 16-18.
- Hill, D. A. 1986. Seasonal differences in the spatial relations of adult male rhesus macaques. Pages 159-172 in Rawlins, R. G. and M. J. Kessler, eds. The Cayo Santiago Macaques: History, Behavior and Biology. State University of New York Press, Albany, NY.
- \_\_\_\_\_. 1986. Social relationships between adult male and immature rhesus macaques. *Primates* 27: 425-440.
- \_\_\_\_\_. 1987. Social relationships between adult male and female rhesus macaques: 1. Sexual consortships. *Primates* 28: 439-456.
- \_\_\_\_\_. 1990. Social relationships between adult male and female rhesus macaques: II. Non-sexual affiliative behavior. *Primates* 31: 33-50.
- \_\_\_\_\_. 1994. Affiliative behaviour between adult males of the genus *Macaca*. *Behaviour* 130: 293-308.
- Holloway, R. L. 1974. Primate aggression, territoriality, and xenophobia: A comparative perspective. Academic Press, New York. 513 pp.
- Holmes, G. P., L. E. Chapman, J. A. Stewart, S. E. Straus, J. K. Hilliard, and D. S. Davenport. 1995. Guidelines for the prevention and treatment of B-virus infections in exposed persons. The B Virus Working Group. *Clin. Infect. Dis.* 20: 421-439.
- \_\_\_\_\_, J. K. Hilliard, K. C. Klontz, A. H. Rupert, C. M. Schindler, E. Parrish, D. G. Griffin, G. S. Ward,

- N. D. Bernstein, T. W. Bean, M. R. Ball Sr., J. A. Brady, M. H. Wilder, and J. E. Kaplan. 1990. B virus (*Herpesvirus simiae*) infection in humans: Epidemiologic investigation of a cluster. *Annals of Internal Medicine* 112: 833-839.
- Horrocks, J. A. 1986. Life history characteristics of a wild population of vervets (*Cercopithecus aethiops sabeus*) population in Barbados, West Indies. *Int. J. Primatol.* 7: 31-47.
- \_\_\_\_\_ and J. Baulu. 1988. Effects of trapping on the vervet (*Cercopithecus aethiops sabeus*) population in Barbados. *Am. J. Primatol.* 15: 223-233.
- Huff, J. L. and P. A. Barry. 2003. B-virus (*Cercopithecine herpesvirus 1*) infection in humans and macaques: potential for zoonotic disease. *Emerging Infectious Diseases* 9(2): 11 pp.
- Jensen, K., F. Alvarado-Remy, J. Gonzalez-Martinez, E. Kraiselburd, and J. Rulluan. 2004. Herpesvirus B Outside of the Laboratory: Free-Ranging Rhesus Macaques in Puerto Rico. *Emerging Infectious Diseases* March 2004: Vol. 10, No. 3. 7 pp.
- Johnson, R. L., C. M. Berman, I. Malik. 1993. An integrative model of the lactational and environmental control of mating in female rhesus monkeys. *Anim. Behav.* 46: 63-78.
- \_\_\_\_\_, I. Malik, and C. M. Berman. 1991. Age- and dominance-related variation in feeding time among free-ranging female rhesus monkeys. *Internat. J. Primatol.* 12: 337-356.
- Jones, M. L. 1982. Longevity of captive mammals. *Zool Garten* 52: 113-128.
- Kaplan, J. R. and E. Zucker. 1980. Social organization in a group of free-ranging patas monkeys. *Folia Primatol.* 34: 196-213.
- \_\_\_\_\_, D. K. Chikazawa, and S. B. Manuck. 1987. Aspects of fight interference in free-ranging and compound-dwelling rhesus macaques (*Macaca mulatta*). *Am. J. Primatol.* 12: 287-298.
- Kapsalis, E. 1985. The status of a translocated troop from Cayo Santiago to a hill corral after one year. *Am. J. Primatol.* 8: 346. Abstract.
- \_\_\_\_\_ and C. M. Berman. 1996. Models of affiliative relationships among free-ranging rhesus monkeys (*Macaca mulatta*): II. Testing predictions for three hypothesized organizing principles. *Behaviour* 133: 1235-1263.
- Kay, R. F. and J. G. H. Cant. 1988. Age assessment using cementum annulus counts and tooth wear in a free-ranging population of *Macaca mulatta*. *Am. J. Primatol.* 15: 1-15.
- Kerber, W. T., H. J. Herbert, and J. H. Vickers. 1979. Establishing a free-ranging breeding colony of rhesus monkeys. Part I. *J. Med. Primatol.* 8: 129-142.
- Kessler, M. J., J. D. Berard, and R. G. Rawlins. 1988. Effect of tetanus toxoid inoculation on mortality in the Cayo Santiago macaque population. *Am. J. Primatol.* 15: 93-101.
- \_\_\_\_\_ and J. K. Hilliard. 1990. Seroprevalence of B virus (*Herpesvirus simiae*) antibodies in a naturally formed group of rhesus macaques. *J. Med. Primatol.* 19: 155-160.

- \_\_\_\_\_, W. T. London, R. G. Rawlins, J. Gonzalez, H. S. Martinez, and J. Sanchez. 1985. Management of a harem breeding colony of rhesus monkeys to reduce trauma-related morbidity and mortality. *J. Med. Primatol.* 14: 91-98.
- \_\_\_\_\_ and R. G. Rawlins. 1984. Absence of naturally acquired tetanus antitoxin in free-ranging Cayo Santiago rhesus monkeys (*Macaca mulatta*). *J. Med. Primatol.* 13: 353-357.
- \_\_\_\_\_, B. Yarbrough, R. G. Rawlins, and J. Berard. 1984. Intestinal parasites of the free-ranging Cayo Santiago rhesus monkeys (*Macaca mulatta*). *J. Med. Primatol.* 13: 57-66.
- Knezevich, M. 1996. Geophagy and parasitism in a free-ranging group of rhesus macaques. *Internat. Primatol. Soc. Primatol. Absts.* # 567. Abstract.
- \_\_\_\_\_. 1998. Geophagy as a therapeutic mediator of endoparasitism in a free-ranging group of rhesus macaques (*Macaca mulatta*). *Am. J. Primatol.* 44: 71-82.
- Koford, C. B. 1965. Population dynamics of rhesus monkeys on Cayo Santiago. Pages 160-174 in I. DeVore, ed. *Primate behavior: field studies of monkeys and apes*. Holt, Rinehart, and Winston, New York. 654 pp.
- Kurland, J. A. 1973. A natural history of Kra macaques (*Macaca fascicularis* Raffles, 1821) at the Kutai Reserve, Kalimantan Timur, Indonesia. *Primates* 14: 245-262.
- Laudenslager, M. L., K. L. R. Rasmussen, A. A. Lilly, and O. Laban, et al. 1998. Immune and endocrine changes following brief capture experiences in free-ranging macaques. *Am. J. Primatol.* 45: 192. Abstract.
- \_\_\_\_\_, \_\_\_\_\_, K. C. M. Berman, A. A. Lilly, S. E. Shelton, N. H. Kalin, and S. J. Suomi. 1999. A preliminary description of responses of free-ranging rhesus monkeys to brief capture experiences: Behavior, endocrine, immune and health relationships. *Brain Behav. Immunol.* 13: 124-137.
- Leopold, A.S. 1933. *Game management*. Charles Scribner & Sons, New York, NY. 481 pp.
- Lindburg, D. G. 1971. The rhesus monkey in north India: An ecological and behavioral study. *Primate Behav.* 2: 1-106.
- \_\_\_\_\_. 1980. *The macaques: studies in ecology, behavior and evolution*. Van Nostrand Reinhold, New York. 384 pp.
- Lippold, L. K. 1989. Mona monkeys of Grenada. *Primate Conservation* 10: 22-23.
- Loomis-Huff, J. E., R. Eberle, K. M. Lockridge, G. Rhodes, and P. A. Barry. 2001. Immunogenicity of a DNA vaccine against herpes B virus in mice and rhesus macaques. *Vaccine* 19: 4865-4873.
- Loy, J. 1975. The copulatory behaviour of adult male patas monkeys, *Erythrocebus patas*. *J. Reprod. Fert.* 45: 193-195.
- \_\_\_\_\_. 1981. The reproductive and heterosexual behaviours of adult patas monkeys in captivity. *Anim. Behav.* 29: 714-726.

- \_\_\_\_\_. 1989. Studies of free-ranging and corralled patas monkeys at La Parguera, Puerto Rico. Pages 129-131 in M. J. Kessler, ed. Proceedings of the Meeting to Celebrate the 50<sup>th</sup> Anniversary of the Cayo Santiago Rhesus Monkey Colony. Puerto Rico Health Science J. 8: 129-131.
- \_\_\_\_\_ and M. Harnois. 1988. An assessment of dominance and kinship among patas monkeys. *Primates* 29: 331-342.
- Mahaney, W. C., A. Stambolic, M. Knezevich, R. G. V. Hancock, S. Aufreiter, K. Sanmugadas, M. J. Kessler, and M. D. Gryn timer. 1995. Geophagy amongst rhesus macaques on Cayo Santiago, Puerto Rico. *Primates* 36: 323-333.
- Malik, I., R. L. Johnson, and C. M. Berman. 1992. Control of postpartum mating behavior in free-ranging rhesus monkeys. *Am. Primatol.* 26: 89-95.
- Manson, J. H. 1992. Measuring female mate choice in Cayo Santiago rhesus macaques. *Anim. Behav.* 44: 405-416.
- \_\_\_\_\_. 1993. Sons of low-ranking female rhesus macaques can attain high dominance ranks in their natal groups. *Primates* 34: 285-288.
- \_\_\_\_\_. 1994. Male aggression: A cost of female mate choice in Cayo Santiago rhesus macaques. *Anim. Behav.* 48: 473-475.
- \_\_\_\_\_. 1994. Mating patterns, mate choice and birth season heterosexual relationships in free-ranging rhesus macaques. *Primates* 35: 417-433.
- \_\_\_\_\_. 1995. Rhesus macaques copulations calls: Reevaluating the "honest signals" hypothesis. *Am. J. Phys. Anthropol. Suppl.* 20: 142. Abstract.
- \_\_\_\_\_. 1995. Do female rhesus macaques choose novel males? *Am. J. Primatol.* 37: 285-296.
- \_\_\_\_\_. 1996. Male dominance and mount series duration in Cayo Santiago rhesus macaques. *Anim. Behav.* 51: 1219-1231.
- \_\_\_\_\_ and S. E. Perry. 1993. Inbreeding avoidance in rhesus macaques: Whose choice? *Am. J. Phys. Anthropol.* 90: 335-344.
- Marriot, B. M. 1988. Time budgets of rhesus monkeys (*Macaca mulatta*) in a forest habitat in Nepal and Cayo Santiago. Pages 125-149 in J. E. Fa and C. H. Southwick, eds. Ecology and Behavior of Food-Enhanced Primate Groups. New York, Alan R. Liss, Inc.
- \_\_\_\_\_, E. Pearson, J. Roemer, and R. O. Woodbury. 1993. Selection of dietary supplements by free-ranging rhesus monkeys on Cayo Santiago. *Am. J. Primatol.* 30: 332. Abstract.
- \_\_\_\_\_, J. Roemer, and C. Sultana. 1989. An overview of the food intake patterns of the Cayo Santiago rhesus monkeys (*Macaca mulatta*): Report of a pilot study. Pages 87-94 in M. J. Kessler, ed. Proceedings of the Meeting to Celebrate the 50<sup>th</sup> Anniversary of the Cayo Santiago Rhesus Monkey Colony. Puerto Rico Health Science J. 8: 87-94.



- McGuire, M. T. 1974. The St. Kitts vervet. Karger, New York. 199 pp.
- McMillan, C. A. 1989. Male age, dominance and mating success among rhesus macaques. *Am. J. Phys. Anthropol.* 80: 83-89.
- Meikle, D. B. and S. H. Vessey. 1988. Maternal dominance rank and lifetime survivorship of male and female rhesus monkeys. *Behav. Ecol. Sociobiol.* 22: 379-383.
- Mohnot, S. M. 1978. The conservation of non-human primates in India. Pages 47-53 in Chivers, D. J. and W. Lane-Petter, eds. *Recent Advances In Primatology. II. Conservation*. Academic Press, London. 312 pp.
- Morrison, J. A. and E. W. Menzel. 1972. Adaptations of a free-ranging rhesus monkey group to division and transplantation. *Wildl. Monographs* 31: 1-78.
- Napier, J. R. and P. H. Napier. 1985. The natural history of primates. The MIT Press, Cambridge, Massachusetts.
- National Institute for Occupational Safety and Health. 2001. *Cercopithecine herpesvirus 1 (B Virus)* infection resulting from ocular exposure. *Occup. Environ. Hyg.* 16: 32-34.
- Nieuwenhuisen, K., Ad J. J. C. Lammers, K. J. de Neef, and A. K. Slob. 1985. Reproduction and social rank in female stump-tail macaques (*Macaca arctoides*). *Internatl. J. Primatol.* 6: 77-99.
- Nieves, P., J. F. Rodriguez, M. J. Kessler, and F. B. Bercovitch. 1996. Subcutaneous rabies vaccination of pigtail macaques. *J. Med. Primatol.* 25: 14-16.
- Norman, H. A. and Committee on Nonhuman Primates. 1981. Techniques for the study of primate population ecology. National Academy Press, Washington, D.C. 233 pp.
- Ohsawa, H., M. Inoue, and O. Takenaka. 1993. Mating strategy and reproductive success of male patas monkeys (*Erythrocebus patas*). *Primates* 34: 533-544.
- Orford, H. J. L., M. R. Perrin, and H. H. Berry. 1988. Contraception, reproduction and demography of free-ranging Etosha lions (*Panthera leo*). *J. Zool.* 216: 717-733.
- Phillips, R. L., K. S. Gruver, and E. S. Williams. 1996. Leg injuries to coyotes captured in three types of foothold traps. *Wildl. Soc. Bull.* 24(2): 260-263.
- Poirier, J. A. 1972. The St. Kitts green monkey (*Cercopithecus aethiops sabeus*). *Folia Primatol.* 17: 20-55.
- Post, W. and J. Wiley. 1976. The yellow-shouldered blackbird – present and future. *Am. Birds* 30: 13-20.
- Raffaele, H. A. 1989. A guide to the Birds of Puerto Rico and the Virgin Islands. Princeton University Press, New Jersey. 254 pp.
- Rasmussen, K. and S. Suomi. 1989. Heart rate and endocrine responses to stress in adolescent male

- rhesus monkeys on Cayo Santiago. Pages 65-71 in M. J. Kessler, ed. Proceedings of the Meeting to Celebrate the 50<sup>th</sup> Anniversary of the Cayo Santiago Rhesus Monkey Colony. Puerto Rico Health Science J. 8: 65-71.
- \_\_\_\_ and \_\_\_\_\_. 1993. Aggressiveness, wounding and biobehavioral profiles of adolescent male rhesus macaques on Cayo Santiago. *Am. J. Primatol.* 30: 343. Abstract.
- Rasmussen, K. L. R., J. D. Berard, and S. J. Suomi. 1995. Extremes of social integration: Biobehavioral patterns of solitary vs. social males in Cayo Santiago rhesus macaques. *Am. J. Primatol.* 36: 150. Abstract.
- \_\_\_\_, A. Timme, and S. J. Suomi. 1997. Comparison of physiological measures of Cayo Santiago rhesus monkey females within and between social groups. *Primate Report* 47: 49-55.
- Rawlins, R. G. 1989. Perspectives on the history of colony management and the study of population biology at Cayo Santiago. Pages 33-41 in M. J. Kessler, ed. Proceedings of the Meeting to Celebrate the 50<sup>th</sup> Anniversary of the Cayo Santiago Rhesus Monkey Colony. Puerto Rico Health Science J. 8: 33-41.
- \_\_\_\_, G. K. Adaniya, M. J. Kessler, and J. Berard. 1991. Matrix model for sustained harvesting of primate populations. *Am. J. Primatol.* 24: 129. Abstract.
- \_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, and \_\_\_\_\_. 1992. Demographic effects of large scale cropping on population growth at Cayo Santiago. *Am. J. Primatol.* 27: 52. Abstract.
- \_\_\_\_, M. J. Kessler, and J. E. Turnquist. 1984. Reproductive performance, population dynamics and anthropometrics of the free-ranging Cayo Santiago rhesus macaques. *J. Med. Primatol.* 13: 247-259.
- \_\_\_\_ and \_\_\_\_\_. 1985. Environmental factors and seasonal reproduction in the Cayo Santiago macaques. *Am. J. Primatol.* 8: 359. Abstract.
- \_\_\_\_ and \_\_\_\_\_. 1985. Climate and seasonal reproduction in the Cayo Santiago macaques. *Am. J. Primatol.* 9: 87-99.
- \_\_\_\_ and \_\_\_\_\_. 1986. The Cayo Santiago macaques – History, behavior and biology. State University of New York Press, Albany. 306 pp.
- \_\_\_\_ and \_\_\_\_\_. 1986. Secondary sex ratio variation in the Cayo Santiago macaque population. *Am. J. Primatol.* 10: 9-23.
- \_\_\_\_ and \_\_\_\_\_. 1986. Population growth as a function of demographic constraints on component social groups in the Cayo Santiago macaque colony. *Am. J. Primatol.* 10: 425. Abstract.
- \_\_\_\_, \_\_\_\_\_, J. Berard, and G. K. Adaniya. Differential troop growth in relation to population dynamics of the Cayo Santiago macaques. *Am. J. Primatol.* 18: 163. Abstract.
- Raymond, P. W. 1984. Sea Turtle hatchling disorientation and beach front lighting. A review of the problem and potential solutions. The Center for Environmental Education. Sea Turtle Rescue Fund. Washington, D. C. 72 pp.

- Reichs, K. J. and C. J. DeRousseau. 1985. Secular trend toward increasing body size in rhesus monkeys. *Am. J. Phys. Anthropol.* 66: 217. Abstract.
- Rendall, D., P. S. Rodman, and R. E. Emond. 1996. Vocal recognition of individuals and kin in free-ranging rhesus monkeys. *Anim. Behav.* 51: 1007-1015.
- Renquist, D. M. and R. A. Whitney. 1987. Zoonoses acquired from pet primates. *Veterinary Clinics of North America: Small Animal Practice* 17(1): 219-240.
- Richard, A. F. 1985. *Primates in Nature*. W. H. Freeman and company, New York. 467 pp.
- Rodman, P. S. 1978. Diets, densities, and distributions of Bornean primates. Pages 465-478 in Montgomery, G. G., ed. The ecology of arboreal folivores. Smithsonian Inst. Press, Washington, D.C. 573 pp.
- Roonwal, M. L. and S. M. Mohnot. 1977. *Primates of South Asia*. Harvard Univ. Press, Cambridge. 421 pp.
- Rosenbaum, B., T. O'Brian, M. Kinnard, and J. Supriana. 1998. Population densities of Sulawesi crested black macaques on Bacan and Sulawesi, Indonesia: Effects of habitat disturbance and hunting. *Am. J. Primatol.* 44(2): 89-106.
- Rowell, T. E. 1971. Organization of caged groups of *Cercopithecus* monkeys. *Anim. Behav.* 19: 625-645.
- \_\_\_\_\_ and K. M. Hartwell. 1978. The interaction of behavior and reproductive cycles in patas monkeys. *Behavioral Biology* 24: 141-167.
- \_\_\_\_\_ and S. M. Richards. 1979. Reproductive strategies of some African monkeys. *J. Mammal.* 60: 58-69.
- Sade, D. S. 1967. Determinants of dominance in a group of free-ranging rhesus monkeys. Pages 99-114 in Altmann, S. A., ed. Social Communication Among Primates. Univ. Chicago Press. 392 pp.
- \_\_\_\_\_ and R. W. Hildebrech. 1965. Notes on the green monkey (*Cercopithecus aethiops sabeus*) on St. Kitts, West Indies. *Carib. J. Sci.* 5: 67-81.
- Schwartz, S. M., J. W. Kemnitz, and C. F. Howard Jr. 1993. Obesity in free-ranging macaques. *Internat. J. Obesity* 17: 1-9.
- Shah, K. V. 1998. SV40 infections in simians and humans. *Developments Biol. Std.* 94: 9-12.
- Simonds, P. E. 1965. The bonnet macaque in South India. Pages 175-196 in DeVore, I., ed. Primate behavior: Field Studies of monkeys and apes. Holt, Rinehart and Winston, New York, 654 pp.
- Slate, D.A., R. Owens, G. Connolly, and G. Simmons. 1992. Decision making for wildlife damage management. *Trans. N. A. Wildl. Nat. Res. Conf* 57:51-62.
- Southwick, C. H. 1988. Partial recovery and a new population estimate of rhesus populations in India.

- Am. J. Primatol. 16: 187-197.
- \_\_\_\_\_. 1989. The role of Cayo Santiago in primate field studies. *Puerto Rico Health Sciences Journal* 8: 47-51.
- \_\_\_\_\_, M. A. Beg, and M. F. Siddiqi. 1965. Rhesus monkeys in northern India. Pages 111-159 in I. DeVore, ed. Primate behavior: Field studies of monkeys and apes. Holt, Rinehart and Winston, New York. 654 pp.
- \_\_\_\_\_ and M. F. Siddiqi. 1977. Population dynamics of rhesus monkeys in northern India. Pages 339-362 in Rainer III, Prince of Monaco and G. H. Bourne, eds. Primate Conservation. Academic Press, New York. 658 pp.
- \_\_\_\_\_ and \_\_\_\_\_. 1994. Primate commensalisms: the rhesus monkey in India. *Rev. Ecol. (Terre Vie)* 49: 223-231.
- \_\_\_\_\_, \_\_\_\_\_, J. A. Cohen, J. R. Oppenheimer, J. Khan, and S. W. Ashraf. 1982. Further declines in rhesus populations of India. Pages 128-137 in Chiarelli, A. B. and R. S. Corruccini, eds. Advanced views in primate biology. Springer-Verlag, Berlin. 266pp.
- \_\_\_\_\_, \_\_\_\_\_, and J. R. Oppenheimer. 1983. Twenty-year changes in rhesus monkey populations in agricultural areas of northern India. *Ecology* 64: 434-439.
- Struhsaker, T. T. and J. S. Gartlan. 1970. Observations on the behavior and ecology of the patas monkey (*Erythrocebus patas*) in the Waza Reserve. *Cameroon J. Zool.* 161: 49-63.
- Sussman, R. W. and I. Tattersall. 1986. Distribution, abundance, and putative ecological strategy of *Macaca fascicularis* on the Island of Mauritius, Southwestern Indian Ocean. *Folia Primatol.* 46: 28-43.
- Taub, D. M. and P. T. Mehlman. 1989. Development of the Morgan Island rhesus monkey colony. Pages 159-169 in M. J. Kessler, ed. Proceedings of the Meeting to Celebrate the 50<sup>th</sup> Anniversary of the Cayo Santiago Rhesus Monkey Colony. *Puerto Rico Health Science J.* 8: 159-169.
- Timme, A., K. L. Rasmussen, and S. J. Suomi. 1997. Temperament, maternal and social behaviour in Cayo Santiago rhesus macaques: Behavioural and physiological relationships. *Advanc. Ethol.* 32: 57. Abstract.
- Turnquist, J. E. and M. J. Kessler. 1989. Free-ranging Cayo Santiago rhesus monkeys (*Macaca mulatta*). I. Body size, proportion and allometry. *Am. J. Primatol.* 19: 1-13.
- Vandenbergh, J. G. 1989. The La Parguera, Puerto Rico colony: Establishment and early studies. Pages 117-119 in M. J. Kessler, ed. Proceedings of the Meeting to Celebrate the 50<sup>th</sup> Anniversary of the Cayo Santiago Rhesus Monkey Colony. *Puerto Rico Health Science J.* 8: 117-119.
- USDA. 1997 (revised). Animal Damage Control program final environmental impact statement. Vol. 1-3. Animal Damage Control. Hyattsville, MD.
- USFWS. 1994. Eradication of feral domestic goats and introduced rhesus macaques (*Macaca mulatta*)

- on Desecheo National Wildlife Refuge. Environmental Assessment. 7 pp.
- Vandenbergh, J. G. and S. Vessey. 1968. Seasonal breeding of free-ranging rhesus monkeys and related ecological factors. *J. Repro. Fertility* 15: 71-79.
- Vessey, S. H. 1984. Dominance among rhesus monkeys. *Political Psychol.* 5: 623-628.
- Weber, H., E. Berge, J. Finch, P. Heidt, F. J. Kaup, G. Perretta, B. Verschuere, and S. Wolfensohn. 1998. Health monitoring of non-human primate colonies. Recommendations of the Federation of European Laboratory Animal Science Associations (FELASA) Working Group on Non-Human Primate Health Accepted by the FELASA Board of Management. 1998.
- Wildlife Society, The. 1990. Conservation policies of The Wildlife Society. The Wildlife Society. Washington, D.C. 20 pp.
- Wiley, J. W., W. Post, and A. Cruz. 1991. Conservation of the yellow-shouldered blackbird *Agelaius xanthomus*, an endangered West Indian species. *Biol. Conserv.* 55: 119-138.
- Wilson, W. L. and A. D. Johns. 1982. Diversity and abundance of selected animal species in undisturbed Forest, selectively logged forest and plantations in East Kalimantan, Indonesia. *Biological Conservation* 24(3): 205-218.
- Witherington, B. E. 1991. Influences of artificial lighting on the seaward orientation of hatchling loggerhead turtles. (*Caretta caretta*). *Biol. Conserv.* 55:139-149.
- \_\_\_\_\_. 1995. Hatchling orientation. A Summary. Pages 577-578 in K. A. Bjorndal, ed., Biology and Conservation of sea turtles. Revised Edition. Smithsonian Institution Press. Washington D.C.
- \_\_\_\_\_ and R. E. Martin. 1996. Understanding, assessing, and resolving light-pollution problems on sea turtle nesting beaches. FMRI Tech. Rep. TR-2. Florida Marine Research Institute, St. Petersburg, Florida. 73p.
- Wolfe, N. D., A. A. Escalante, W. B. Karesh, A. Kilbourne, A. Spielman, and A. A. Lal. 1998. Wild primate populations in emerging infectious disease research: the missing link? *CDC, Emerging Infectious Diseases* 4(2): 13 pp.
- Wolfheim, J. H. 1983. *Primates of the World: Distribution, abundance, and Conservation*. Univ. Washington Press, Seattle. 831 pp.
- WWHC (Western Wildlife Health Committee). *Undated*. A model protocol for purchase, distribution, and use of pharmaceuticals in wildlife. Western Association of Fish and Wildlife Agencies. Contact: J. deVos, AZ Game and Fish Dept., 2221 W. Greenway Rd., Phoenix, AZ 85023. 9 p.
- Zorpette, G. 1995. The importance of being sneaky: Dominance may not be key to mating of rhesus macaques. *Scientific Am.* 272: 29-31.
- Zucker, E. L. 1987. Social status and the distribution of social behavior by adult female patas monkeys:

A comparative perspective. Pages 151-173 in E. L. Zucker, ed. Comparative Behavior of African Monkeys. New York, Alan R. Liss, Inc.

## **APPENDIX B. GLOSSARY**

**Abundance** - The number of individuals of a species in a given unit of area.

**Animal Behavior Modification** - The use of scare tactics/devices (i.e., electronic distress sounds, propane exploders, pyrotechnics, lights, scarecrows, etc.) to deter or repel animals that cause damage to resources or property or threaten human health and safety.

**Animal Rights** - A philosophical and political position that animals have inherent rights comparable to those of humans.

**Animal Welfare** - Concern for the well-being of individual animals, unrelated to the perceived rights of the animal or the ecological dynamics of the species.

**Carnivore** - A species that primarily eats meat (member of the Order Carnivora).

**Confirmed Losses** - Wildlife-caused losses or damages verified by USDA-WS. These figures usually represent a fraction of the total losses.

**Corrective Damage Management** - Management actions applied when damage is occurring or after it has occurred.

**Depredating Species** - An animal species causing damage to, or loss of crops, livestock, other agricultural or natural resources, property, or wildlife.

**Depredation** - The act of killing, damaging, or consuming animals, crops, other agricultural or natural resources, property, or wildlife.

**Direct Control** - Administration or supervision of wildlife damage management by WS, often involving direct intervention to capture depredating animals.

**Endangered Species** - Federal designation for any species or population that is in danger of extinction throughout all or a significant portion of its range.

**Environment** - The conditions, influences, or forces that affect or modify an organism or and ecological community and ultimately determine its form and survival.

**Environmental Assessment** - An analysis of the impacts of a planned action to the human environment to determine the significance of that action and whether an EIS is needed.

**Environmental Impact Statement** - A document prepared by a federal agency to analyze the anticipated environmental effects of a planned action or development, compiled with formal examination of options and risks.

**Eradication** - Elimination of a specific wildlife species, generally considered pests, from designated areas.

**Exotic (Nonnative) Species** - Any plant or animal that is not native to an area; species transplanted by humans that are native to other areas of a county, state, or other parts of a country or species introduced from other countries.

**Feral (Nonnative) Wildlife Species** - Generally, any animal commonly domesticated by humans that is no longer dependent on humans to survive and living in the wild (i.e., escaped livestock, poultry, fowl, dogs, cats, etc.).

**Habitat** - An environment that provides the requirements (i.e., food, water, shelter, and space) essential for the development and sustained existence of a species.

**Habitat Modification/Management** - Protection, destruction, or modification of a habitat to maintain, increase, or decrease its ability to produce, support, or attract designated wildlife species

**Harvest or Kill Data** - An estimate of the number of animals removed from a population by humans.

**Humaneness** - The perception of compassion, sympathy, or consideration for animals from the viewpoint of humans.

**Integrated Pest Management** - The procedure of integrating, applying, and assessing practical pest management methods while minimizing potential harmful effects to humans, nontarget species, and the environment. Often several different techniques are incorporated into a management program (i.e., cultural, exclusion, lethal and nonlethal methods, etc.).

**Integrated Wildlife Damage Management** - See *Integrated Pest Management*. The IPM approach applied to the objective of managing wildlife damage rather than pest animal populations. Often several different techniques are incorporated into a management program (i.e., cultural, exclusion, lethal and nonlethal methods, etc.).

**Lethal Management Methods/Techniques** - Wildlife damage management methods that result in the death of targeted animals (e.g., ground calling and shooting, trapping, denning, etc.).

**Local Population** - The population within an immediate specified geographical area.

**Long-term** - An action, trend, or impact that affects the potential of an event over an extended period of time.

**Macaque** - Any of 16 species of monkey found within the Order Primates; Family Cercopithecidae; genus *Macaca*.

**Magnitude** - Criteria used in this EA to evaluate the significance of impacts on species abundance. Magnitude refers to the number of animals removed in relation to their abundance.

**Nonlethal Control Methods/Techniques** - Wildlife damage management methods or techniques that do not result in the death of targeted animals (e.g., live traps, repellents, pyrotechnics, fences, etc.).

**Nontarget Species/Animals** - An animal species or local population that is inadvertently captured, killed, or injured during wildlife damage management and is not the targeted species/animal.

**Offending Animal/Species** - The individual animal(s) within a specified area causing damage to property, public health and safety, wildlife, natural resources, or to agricultural resources.

**Omnivore/Omnivorous** - An animal that eats both plant and animal matter; a generalist, opportunistic feeder that eats whatever is available.

**Pesticide** - A toxic chemical substance used to control pest animals.

**Population** - A group of organisms of the same species that occupies a particular area.

**Predator** - An animal that kills and consumes another animal.

**Preventive Damage Management** - Management applied before damage begins.

**Prey** - An animal that is killed and consumed by a predator.

**Pyrotechnics** - Specialize fireworks used to frighten wildlife.



**Repellent** - A substance with taste, odor, or tactile properties that discourages specific animals or species from using a food or place.

**Requester** - Individual(s) or agency(ies) that request wildlife damage management assistance from WS.

**Selectivity** - Damage management methods that affect the specific animals or species responsible for causing damage without adversely affecting other species.

**Short-term** - An action, trend, or impact that does not have long lasting affects to the reproductive or survival capabilities of a species.

**Significant Impact** - An impact that will cause important positive or negative consequences to man and his environment.

**Take** - The capture or killing of an animal.

**Target Species/Animal/Population** - An animal, species, or population at which wildlife damage management is directed.

**Technical Assistance** - Advice, recommendations, information, demonstrations, and materials provided to others for managing wildlife damage problems.

**Threatened Species** - Federal designation for a species or population that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.

**Toxicant** - A poison or poisonous substance.

**Unconfirmed Losses** - Losses or damage reported by resource owners or managers, but not verified by WS.

**Wildlife** - Any wild mammal, bird, reptile, or amphibian.

**Wildlife Damage Management** - Actions directed toward resolving livestock or wildlife predation, protecting property, or safeguarding public health and safety in a coordinated, managed program.

**Work Plan** - A management plan developed jointly by WS and other federal, state, individuals, or other private entities specifying when, where, how, and under what constraints wildlife damage management will be conducted. Work plans generally include a map showing areas designated for planned control, restricted control, no control, and special protection.